April 2021 Volume 146 Number 1106

The Naturalist

Yorkshire Naturalists' Union

Journal of Natural History for the North of England

Yorkshire Naturalists' Union

The Naturalist

Vol. 146 No. 1106 April 2021

Contents

An asterisk* indicates a peer-reviewed paper

Front cover: Dormouse in torpor (see page 1). *Photo*: *Ian Court/YDNPA*

Back cover: Flamborough Head, site of the YNU's VC61 excursion for 2021.

The Naturalist

A Summary of Hazel Dormice Conservation Work in The Yorkshire Dales National Park

I.R. Court Wildlife Conservation Officer, Yorkshire Dales National Park Authority.
Email: Ian.court@yorkshiredales.org.uk.
P. Hibbs Dormouse Project Officer, Yorkshire Dales National Park Authority.
Email: Phillip.hibbs@yorkshiredales.org.uk

Introduction
The Hazel Dormouse *Muscardinus avellanarius* (see front cover), hereafter referred to as Dormouse, was once widespread in woodlands across the country but has undergone a significant decline in both numbers and range over the past 100 years (Bright & Morris, 1995). Similarly in North Yorkshire, Howes (2004) concluded that there were still Dormouse populations present in the lower sections of all the major Dales and in the Vale of York up until the first quarter of the 20th century but, with no subsequent confirmed records, the population was considered to be extinct in the county.

Given the population declines and range contraction across large areas of England, the Dormouse was one of the species targeted by the English Nature Species Recovery Programme. Funding enabled a targeted programme of hedgerow and woodland management to be undertaken prior to a national reintroduction programme that began in 1994 (English Nature, 2001). As part of the programme there were two reintroductions in Yorkshire with the first into private woodland near Helmsley in the North York Moors National Park in 1998 (Oxford, 2007). This was followed by another, also in privately owned woodland, near to Masham, Nidderdale, in 2004 (Beer, 2004). This paper details the population monitoring results from two further Dormouse reintroductions in the county, both in the Yorkshire Dales National Park (YDNP). It also summarises the outcomes of the Wensleydale Dormouse Project, a three year partnership project between the Yorkshire Dales National Park Authority (YDNPA) and the People's Trust for Endangered Species (PTES) to increase and improve habitat quality and connectivity to enable the Dormouse population to increase and disperse in mid-Wensleydale.

The first reintroduction site in YDNP was at Freeholders' Wood near Aysgarth in Wensleydale, a 14.9ha semi-natural ancient woodland owned by the YDNPA that has been wooded since at

least 1778. On 23 June 2008, 20 female and 15 male captive-bred Dormice were reintroduced into the wood with details of the reintroduction previously documented by White and Court (2012).

The intention was to create a network of new hedgerows and woodland adjacent to Freeholders' Wood that would provide sufficient habitat connectivity to enable the Dormouse population to disperse into the surrounding area. Although some planting was instigated by the YDNPA following the 2008 release, creating sufficient connectivity across an area where there were multiple landowners proved to be a time-consuming process. It soon became clear that additional staff resource would be required to deliver this on a landscape scale. In addition, it was not possible to deliver all the required capital works under existing agri-environment schemes and so other funding resources would be needed. It was therefore concluded that a project-based approach would be needed to deliver the required conservation work.

There were two strategic developments that helped to facilitate the development of a project. Following a review of the Dormouse reintroduction scheme in 2014 (Natural England, 2014), the strategy was revised to consolidate existing populations by undertaking supplementary reintroductions that would create small clustered metapopulations, rather than have several widely dispersed sites. In addition, a partnership of multiple stakeholders was brought together by the YDNPA and the Yorkshire Dales Rivers Trust to develop the Wensleydale Strategy, a strategic vision that included an aim to improve the environment of Wensleydale and its tributary dales for the benefit of people and nature.

The combination of these factors presented an opportunity to develop the Wensleydale Dormouse Project, a three year partnership project between the YDNPA and PTES, with additional funding secured from the Yorkshire Dales Millennium Trust (YDMT) and Woodland Trust. The over-arching project objective was to create a contiguous network of appropriately managed woodlands and hedgerows in the mid-Wensleydale area to facilitate the expansion of the Dormouse population from the successful reintroduction site at Freeholders' Wood. In order to achieve this objective five key actions were identified and a project officer funded by PTES was appointed two days a week for the duration of the three year project, starting in April 2017 and ending in April 2020. The initial main role of the project officer was to undertake a hedgerow survey and boundary assessment so that these features could be assessed and potential connectivity routes could be identified. These could then be discussed with landowners to determine any constraints and agree definitive routes. Hedgerow and woodland planting and fencing specifications were also written, contracts put out to tender and site visits undertaken with potential contractors. The successful contractors were then supervised and completed works were checked prior to payment.

As part of the project development, a supplementary Dormouse reintroduction was undertaken in a 16.5ha woodland near Carperby in 2016, with 21 female and 17 male captive-bred Dormice released into the woodland on 23 June.

This paper summarises the results of the Dormouse monitoring at both reintroduction sites and details the achievements of the Wensleydale Dormouse Project.

Methodology

Post-release monitoring of both sites has been undertaken annually in accordance with the National Dormouse Monitoring Programme survey methods (PTES, 2011). Nest boxes were checked by licenced fieldworkers each month between May and October. The sex, weight, breeding condition and number of young were recorded for every Dormouse found. In addition, each animal was classed as being either 'adult', 'juvenile' or 'young'. Adults (i.e. animals that have survived at least one winter) were identified by the orange-brown colour of the fur, or juveniles (i.e. independent young in their first year with a weight of >10g) by their more brownish grey fur than adults. Any young were classed as pink (no fur), grey (grey fur and eyes still closed) or eyes open (with grey-brown fur and eyes open). The numbers of boxes that contained distinctive Dormouse nests but had no Dormice were also recorded. The number of Dormice found per 50 boxes is used to compare annual totals.

The peak count of adult Dormice in May and June expressed per 50 boxes is assumed to be in proportion to, and be a reliable measure of, over-winter survival rates. The peak counts of independent (adults and juveniles) and dependents (any aged as pink, grey or eyes open) Dormice in September and October are used to give an indication of breeding success.

The two projects were assessed using the following standardised Natural England (2014) criteria that have been produced in order to evaluate the progress of any reintroduction scheme:

- Short-term: did Dormice survive the first two winters and breed in the third year and,
- Medium term: did the Dormouse population at the release site remain stable over a period of 5-10 years and disperse from there into adjacent areas outside the original wood?

Results

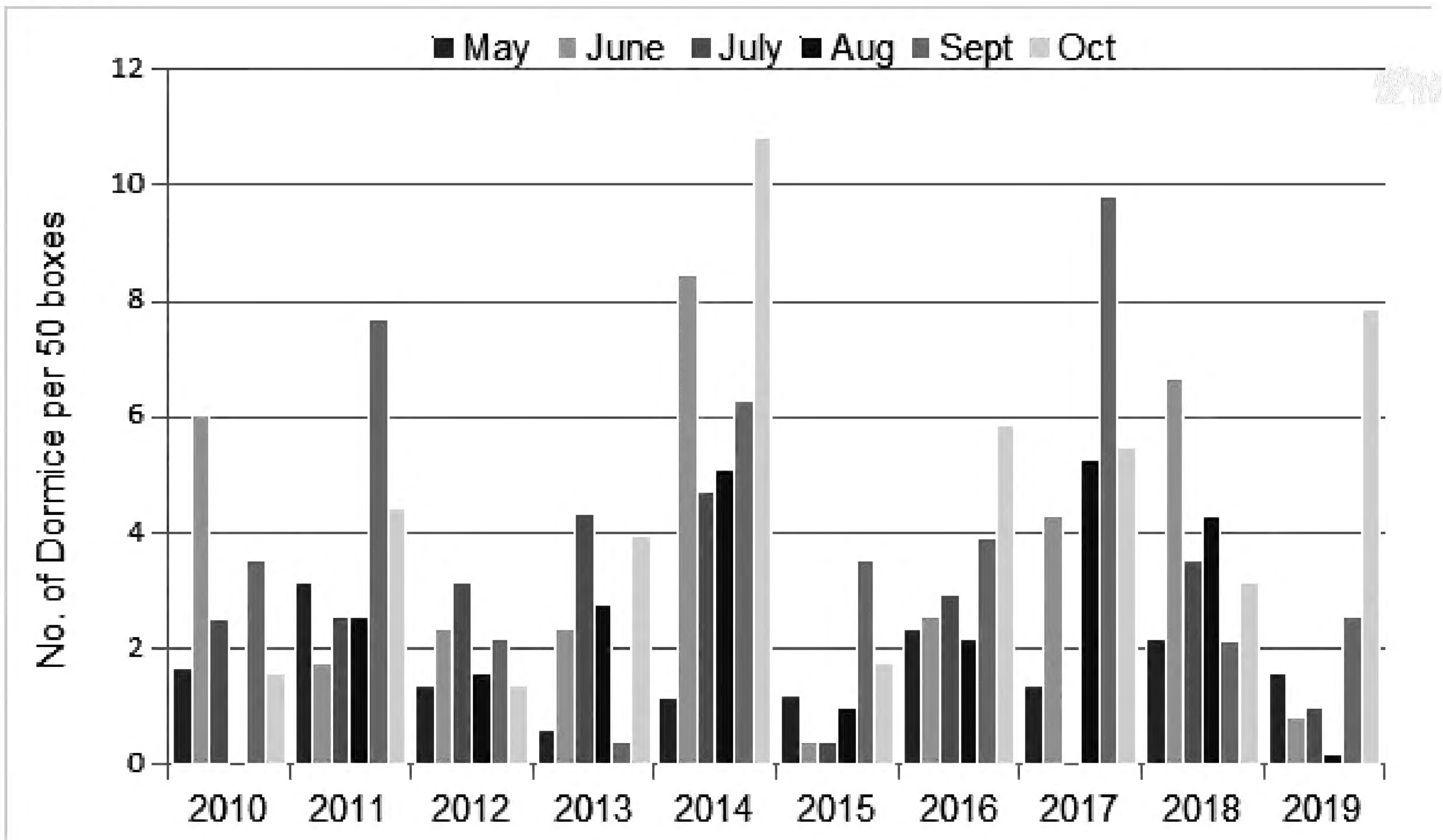

Figure 1. The number of Dormice found per 50 next boxes checked at Freeholders' Wood.

The numbers of Dormice found per 50 nest boxes checked at Freeholders' Wood are shown in Figure 1 and the numbers found at the site near Carperby are shown in Figure 2. The over-winter survival rates for Freeholders' Wood are shown in Figure 3 and for woodland near Carperby in Figure 4. The breeding success for Freeholders' Wood is shown in Figure 5 and for woodland near Carperby in Figure 6.

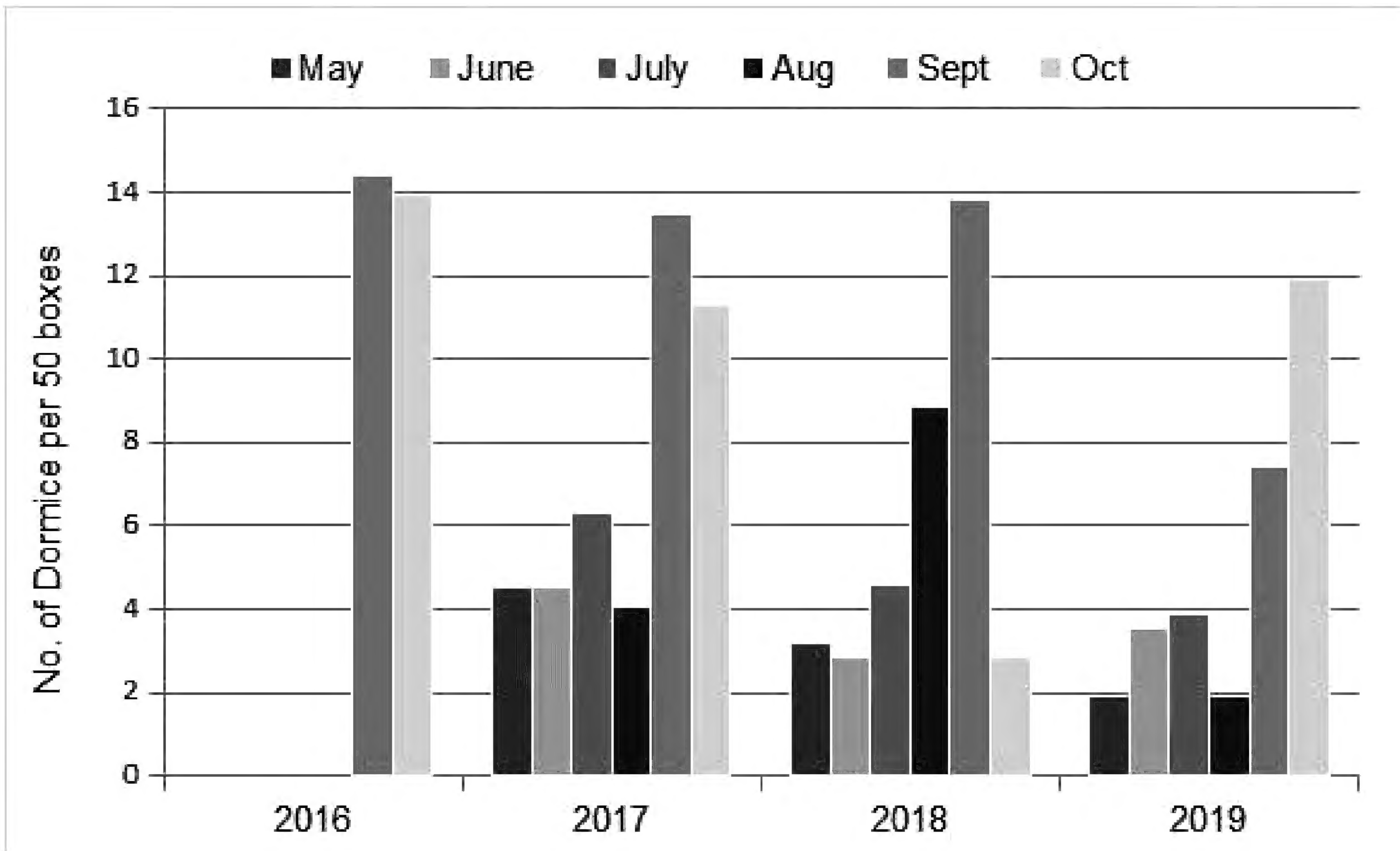

Figure 2. The number of Dormice found per 50 nest boxes checked at a woodland near Carperby.

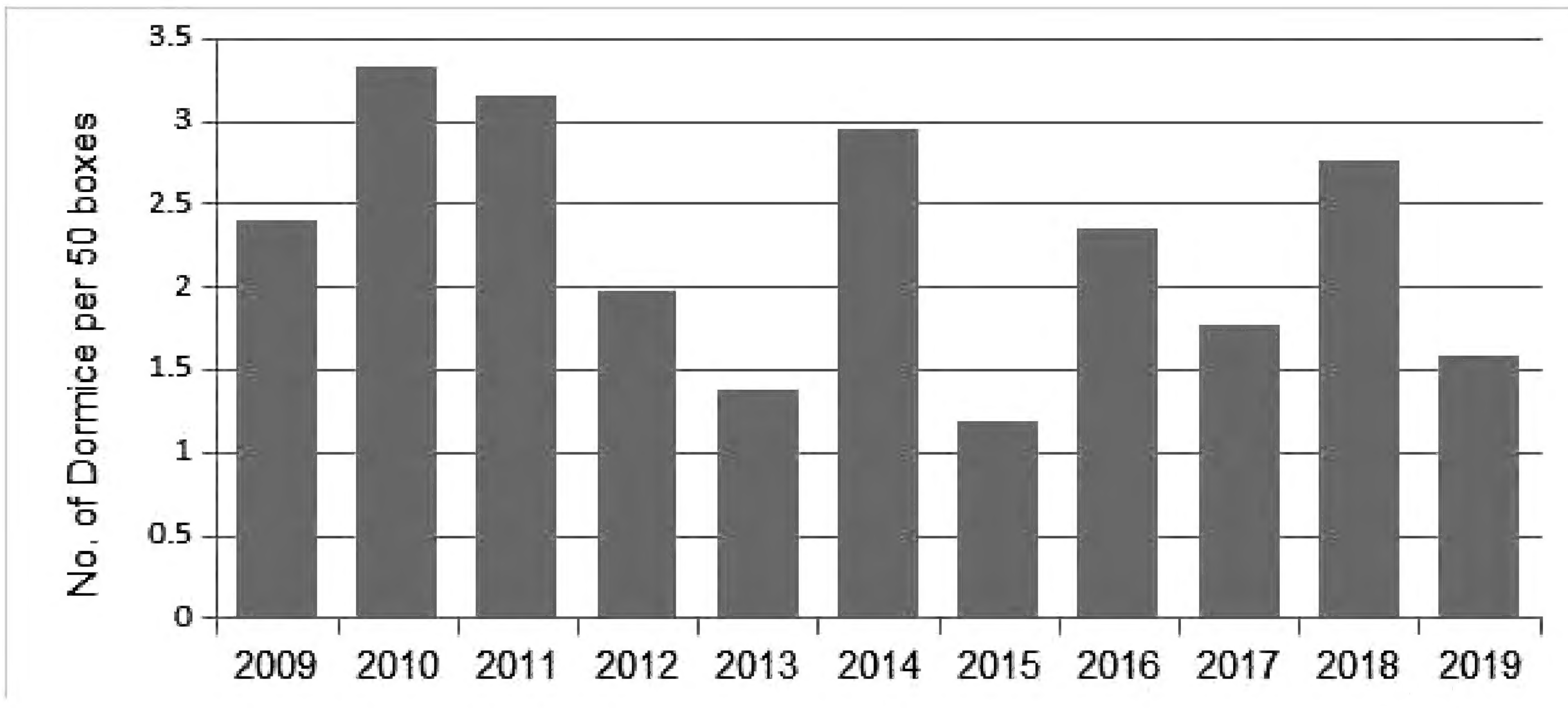

Figure 3. The peak counts of adult Dormice in May and June (excluding any young animals born in that year) expressed per 50 boxes at Freeholders' Wood.

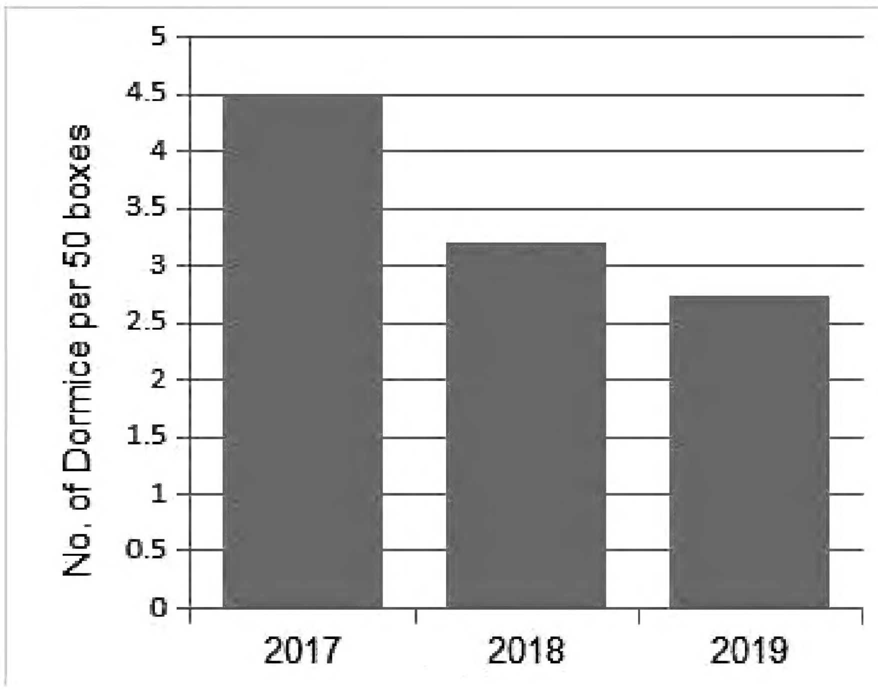

Figure 4. The peak counts of adult Dormice in May and June (excluding any young animals borne in that year) expressed per 50 boxes at Carperby.

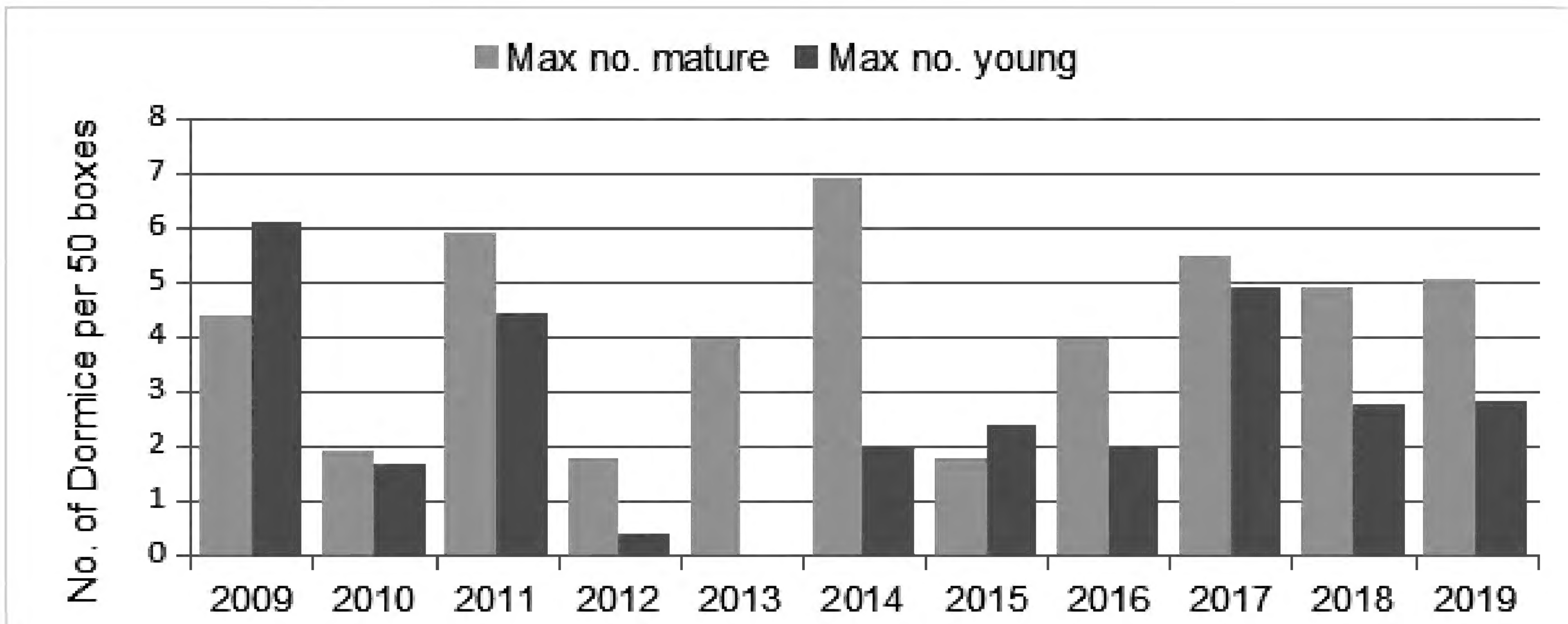

Figure 5. The breeding success expressed as the peak counts of independent (adults and juvenile) and dependent (any aged as pink, grey or eyes open) Dormice in September and October at Freeholders' Wood.

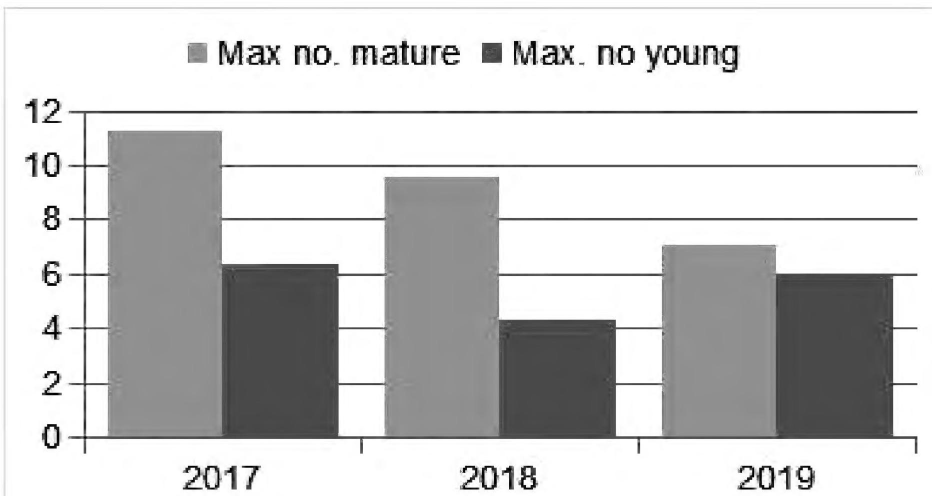

Figure 6. The breeding success expressed as the peak counts of independent (adults and juvenile) and dependent (any aged as pink, grey or eyes open) Dormice in September and October at Carperby.

Determining a definitive population trend at a single site in a relatively short time period is problematic, particularly in years after a reintroduction and with naturally fluctuating annual numbers of Dormice. However, the Dormouse population at Freeholders' is still extant and has been shown to increase following poor years, and so is considered to be stable. In assessing the success of reintroductions using the Natural England (2014) criteria, the Freeholders' Wood scheme has therefore met the first of the Medium Term targets. No survey work has been undertaken outside of the release woodland, and so it is not possible to determine if the secondary target of dispersal into the surrounding areas has been achieved. Dormice have survived the first two winters and bred in the third year at the Carperby site and so the Short Term target has been met.

Wensleydale Dormouse Project

In order to deliver the project objectives the following five key actions with quantifiable targets were identified and costed prior to the start of the project. The targets achieved by the end of the project are also shown as follows:

1. A Hedgerow Survey was undertaken to evaluate all the existing potential connectivity routes within the project area and to identify the quality and extent of the linear hedgerow landscape features. In total, 44.3km of boundary features were assessed, including 12.8km of hedgerows that were surveyed in accordance with the standardised methodology as recommended by PTES and detailed by Defra (2007).

2. In terms of hedgerow management, a minimum of 2.1km of existing unmanaged or gapped hedgerow was identified that would need to be brought into appropriate management and/or 'gapped up'. By the end of the project 2.9km of hedgerows had been brought into favourable management.

3. The target was to plant a minimum of 1.7km of new hedgerow and by the end of the project, 1.6km had been planted. Contracts had been let for a further 200m that were due to be planted in spring 2020 but could not be completed because of the Covid 19 restrictions preventing operational works on the ground. The outstanding work will be undertaken in the 2020/21 planting season, once Covid 19 government guidelines allow. Once completed, a total of 1.8km of new hedgerow will have been planted.

4. Ten small woodland areas (c.2.5ha in total) would also need to be brought into appropriate management for Dormice. By the end of the project ten woodland areas totalling 4.18ha had been brought into appropriate management for Dormice.

5. A number of raising awareness objectives were also identified, including the delivery of four workshops/meetings for land managers and stakeholders in the project area and the production of annual monitoring reports and a project summary report. These aims were reviewed and revised during the course of the project, with two workshops completed and another arranged to take place in March 2020 that was postponed due to Coronavirus restrictions. In addition, annual reports of the Dormouse monitoring in Freeholders' Wood in 2017 (Court & White, 2018) and 2018 (Court, 2019) have been published, with reports assessing the status of the Dormouse population in Freeholders' Wood (Court, 2020a) and a review of the supplementary reintroduction scheme in Wensleydale (Court, 2020b) also published. The project also featured on two regional TV programmes, a number of talks on the project were given to regional

and local conservation groups and there was a presentation detailing the work of the project at the National Dormouse Conference in 2019.

Summary

The Dormouse populations in the YDNP have been monitored annually as part of the National Dormouse Monitoring Programme. Following the reintroduction in 2008, the Dormouse population in Freeholders' Wood is considered to be stable and so has achieved one of the two medium-term success criteria outlined by Natural England (2014). The Dormouse population at a site near Carperby re-introduced in 2017 has survived the first two winters and bred in the third year and has met the Natural England short-term success criteria. In order to determine if the releases meet the other mid-term success criteria, additional survey work will be undertaken to see if Dormice have dispersed into adjacent areas away from the original release sites.

The Wensleydale Dormouse Project ran from April 2017 until April 2020. All the agreed targets were met by the project and, in some cases, exceeded. This has established a network of appropriately managed and connected hedgerows and woodlands in the mid-Wensleydale area that will hopefully facilitate the expansion of the Dormouse population from the two reintroduction sites into the surrounding area. Although it has now finished, the main legacy is that key stakeholders including landowners and managers, are much more aware of the conservation requirements of Dormice within the project area and there are already further proposals for managing existing woodlands and hedgerows and new planting. The baseline data from the hedgerow and boundaries assessments will enable any of these new schemes to be specifically targeted at Dormouse conservation and will help prioritise areas where new planting would be most beneficial and habitat connectivity can be improved.

During the course of the project the number of licenced fieldworkers has increased, improving the options for monitoring. This will enable the monitoring of the two reintroduction sites to continue, and a monitoring programme to be established that will hopefully determine if Dormice have spread into the new areas of suitable habitat that have been created as part of the project.

Acknowledgments

The authors would like to thank Ian White at PTES for his ongoing support and assistance in both reintroduction schemes and the development and delivery of the Wensleydale Dormouse Project. In addition, we would like to thank all the past and present YDNPA staff and volunteers who have been involved with the reintroduction schemes and subsequent monitoring work.

The Wensleydale Dormouse Project was funded by the PTES, YDNPA, YDMT and Woodland Trust. It would not have been possible to deliver this project without the support of the landowners in the Wensleydale area. The project team would also like to thank the Bolton Estate for its ongoing support, in particular Tom Orde-Powlett and Simon Brown, and Richard Dimon (Natural England Conservation Officer) for his help during the project development phase.

We would also like to thank Tony Serjeant for commenting on previous drafts of this paper.

References

Beer, A.J. (2004) A furry tale – the 2004 Yorkshire dormouse reintroduction. *Imprint* 31: 12-18. Yorkshire Mammal Group.

Bright, P.W. & Morris, P.A (1995) A review of the Dormouse *Muscardinus avellanarius* in England and a conservation programme to safeguard its future. *Hystrix* (n.s.) 6(1-2): 295-302.

Court, I.R. & White, I. (2018) *Dormouse Monitoring in Freeholders' Wood 2017.* Yorkshire Dales National Park Authority. Grassington.

Court, I.R. (2019) *A Summary of Dormouse Monitoring at Freeholders' Wood, Aysgarth in 2018.* Yorkshire Dales National Park Authority. Grassington.

Court. I.R. (2020a) *The Status of the Re-introduced Hazel Dormouse Population at Freeholders' Wood.* Yorkshire Dales National Park Authority Conservation Research & Monitoring Report 2020: 2. Yorkshire Dales National Park Authority. Grassington.

Court, I.R. (2020b) *An Assessment of the Supplementary Re-introduction of Dormice into the Yorkshire Dales National Park in 2016.* Yorkshire Dales National Park Authority Conservation Research & Monitoring Report 2020: 3. Yorkshire Dales National Park Authority. Grassington.

Defra (2007) *Hedgerow Survey Handbook: A standard procedure for local surveys in the UK. 2nd Edition*. Department for Environment, Food and Rural Affairs. London.

English Nature. 2001 *The Species Recovery Programme*. English Nature. Peterborough.

Howes, C.A. (2004). Sleepers' in the Dales: Historical records of the Hazel Dormouse *Muscardinus avellanarius* in the Yorkshire Dales National Park. *Proceedings of the Conference on The Biodiversity of the Yorkshire Dales. Supplement to Yorkshire Naturalists' Union Bulletin* 42: 87-89.

Natural England (2014) *Natural England Commissioned Report NECR144. The Dormouse Reintroduction Programme: A review.* Natural England, Peterborough.

Oxford, G. (2007) The Hazel Dormouse Muscardinus avellanarius reintroduction to North Yorkshire. *The Naturalist* 132: 3-8.

PTES (2011) *National Dormouse Monitoring Programme Survey Guidelines and Recording Forms 2011.* People's Trust for Endangered Species. London.

White, I. & Court, I.R. (2012) The Hazel Dormouse release project at Freeholders' Wood in the Yorkshire Dales National Park. *The Naturalist* 137: 82-88.

How many birdwatchers does it take…?

David Gosney

Email: dave@easybirder.co.uk

Introduction

In Gosney 2018a I listed a number of drawbacks of a traditional 'tetrad atlas survey' (ie. one which lists the species in every tetrad and shows the distribution of each species at that time). I argued instead that the use of 1-hour bird counts in Timed Tetrad Visits (TTVs) would give details of numbers, not just distribution, controls for the amount of effort involved and can be completed and published more quickly even if fewer observers are involved. However, this method has its drawbacks too: the number counted in any hour could vary according to the date, the time, the weather, the route and, most especially, the skills of the observer (see Gosney, 2020) and, in any hour, even the best observer is likely to miss more than 40% of the

species present, including, of course, most, if not all, of the nocturnal or crepuscular ones.

Separate evening visits are needed to monitor nocturnal birds (see Gosney, 2018b, 2018c) and observer bias can be overcome by using only the most competent birders or using the same observers in successive surveys.

The problems of species being missed and the sheer variability of the counts can be mitigated by making more than one count per tetrad. However, if a survey is restricted to only a few most-competent observers there is a limit to how many hours can be devoted to each tetrad. This paper explores how many 1-hour counts are needed per tetrad to achieve different aims and when they should be carried out.

Method

TTVs were carried out by the author in all 25 tetrads in SK28 (Hathersage) in April 2020. This was repeated in May 2020 and again in June 2020. In all visits, counts were made of every bird seen or heard, ignoring those flying high overhead and also fledglings/juveniles. Each visit was carefully planned to include as many habitats as possible to maximise the range of species found. The route taken in each tetrad was pretty much the same in each month; this makes it easier to compare one month with another. The data were analysed to illustrate which month(s) produced the most comprehensive species lists and also the highest counts for each bird. The number of species found was compared with the results of an 'unlimited-time' tetrad atlas survey carried out by the Sheffield Bird Study Group (SBSG) over 6 breeding seasons, 2003-08 (Wood & Hill, 2013).

Results

Aim 1. To achieve the most comprehensive species list for each tetrad.
In Table 1 the mean number of species per tetrad found in different months is compared with the number of species found, given unlimited time, during the SBSG survey in 2003-08.

Survey	Time spent	No of tetrads	Mean no of species	% of SBSG total
SBSG (2003-08)	Unlimited	25	58	100
DG (April 2020)	1 hour	25	31	55
DG (May 2020)	1 hour	25	34	59
DG (June 2020)	1 hour	25	33	59
DG (Apr+May 2020)	2 hours	25	41	72
DG (May+Jun 2020)	2 hours	25	42	73
DG (Apr+Jun 2020)	2 hours	25	42	73
DG (Apr+May+Jun 2020)	3 hours	25	46	82

Table 1. Mean numbers of species found in the tetrads of SK28 during different surveys

May and June proved to be equally good months for finding the most birds in an hour, both yielding 59% on average of those found in unlimited time by SBSG. By combining the counts in May and June that figure rose to 73% (similar to the 72% achieved by combining May and April) and, if counts from all 3 months are included, then 82% on average of the 'expected' birds

were found in each tetrad. Of course, these daytime counts rarely pick up any nocturnal birds. If these are excluded then the proportion found in May-June would be 76% and if the results of all 3 visits are combined then an average of 86% of the diurnal birds were found. These figures might be higher still if the two counts are planned to cover different parts of the tetrad instead of, as in this case, repeating the same walk. Clearly, three hours of effort yields more species than two but, if only two hours can be achieved, when should those counts be made?

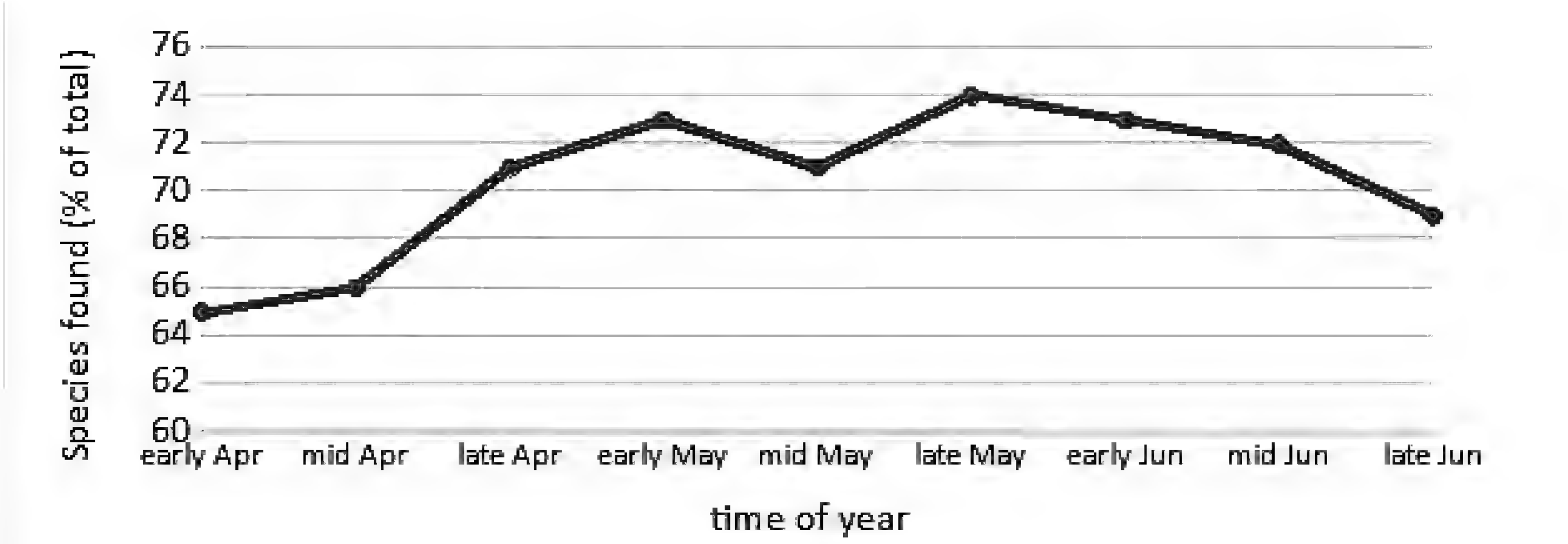

Figure 1. Mean proportion of species found during 1-hour visits at different times of the breeding season.

Figure 1 breaks the data down into 9 periods through the breeding season and shows how the mean proportion of species found per TTV varied over that time. Here, the 'proportion' is taken as the percentage of species found in each visit compared with the total number found on all the 3 counts.

Note that the proportion of species recorded on each visit is highest in late May but is consistently high from late April to mid June. Only the counts in early and mid April and late June failed to achieve at least 70% of the total.

For interest, in the 1-hour counts, the following birds were found in one month only:

April only: Goosander *Mergus merganser*, Woodcock *Scolopax rusticola*.

May only: Coot *Fulica atra*, Tawny Owl *Strix aluco,* Redwing *Turdus iliacus*, Lesser Whitethroat *Sylvia curruca*.

June only: Kingfisher *Alcedo atthis*, Green Woodpecker *Picus viridis*, Sand Martin *Riparia riparia*, Grasshopper Warbler *Locustella naevia.*

And the following were missed in one month only:
Missed in April: Cormorant *Phalacrocorax carbo*, Oystercatcher *Haematopus ostralegus*, Swift *Apus apus*, House Martin *Delichon urbicum*, Spotted Flycatcher *Muscicapa striata*.
Missed in May: Red-legged Partridge *Alectoris rufa*, Common Sandpiper *Actitis hypoleucos*.
Missed in June: Grey Partridge *Perdix perdix*, Wheatear *Oenanthe oenanthe*.

Aim 2. To achieve the most representative counts for each species.
In my surveys of neighbouring SK29 in 2016 and SK27 in 2017 (Gosney 2018d, 2018e) I carried out all the TTVs in May. The above data suggest that a count in late May is indeed the best to get the most comprehensive species list in just one hour, although any time from late April to

mid June was almost as good. However, remember that the aim of the survey is to count the birds – to arrive at a number which best represents how abundant each species is. Maybe some resident birds are best counted in April or some migrant breeders might be best counted in June. Are some being disproportionately missed if the counts are only made in May? If we used the best of two counts, would April and May give more representative numbers of more species than May and June?

Table 2 assumes that the most representative number for each bird in each tetrad is the highest count achieved in the 3 visits and compares this with the numbers achieved on each visit or combination of visits. So, if the counts for species x in tetrad Y were 8 in April, 16 in May and 12 in June then the May count was 100% of the highest count, June was 75% and April was 50%. If these figures are added up for every species and every tetrad we get a measure, for each month or each combination of months, of how close we are to reaching the most representative count for all species.

Survey	**Hours spent**	**Mean % compared with highest count**	**No of under-recorded species (out of 77)**
DG (April)	25	50%	33
DG (May)	25	60%	23
DG (June)	25	58%	26
DG (Apr and Jun)	50	82%	6
DG (Apr and May)	50	85%	4
DG (May and Jun)	50	85%	0
DG (Apr May and Jun)	75	100%	0

Table 2. Mean counts of all* birds in 25 tetrads in SK28 in different months in 2020 expressed as a mean % of the highest counts achieved in any month.
(* apart from scarce species that were not reported in more than 3 tetrads in any month. The figures have also been adjusted to exclude birds thought to be passage or non-breeding birds – see text.)

In each month, some birds will be 'under-counted' but others will be counted in greater numbers than in the other months. Overall, the numbers counted on any single 1-hour visit will be just over half on average of the 'highest count' numbers, with May and June (60% and 58%) clearly more productive than April (50%).

Suppose we say that a bird is under-recorded if the total found was less than 50% of the highest of the 3 counts. If just one month's data is used then about a third of the species were under-recorded; the May counts under-recorded the fewest species (23), slightly better than June (26 species) and much better than April (33 species).

For some birds, counts in April or June can be particularly misleading: In April the birds counted may include a proportion of passage or even wintering birds. April flocks of 8 Fieldfares *Turdus pilaris* and 80 Starlings *Sturnus vulgaris* were clearly wintering birds (and were ignored in this analysis) but how many of the April Ring Ouzels *Turdus torquatus* and Wheatears were passage birds? In one tetrad I counted 11 Ring Ouzels in April but only 1 bird there subsequently. I

counted no Wheatears at all in June; is that because none of the birds I found in April and May stayed to breed? The April count of Lesser Redpolls *Carduelis cabaret* is greatly inflated by a single flock of 12 birds – were they just wintering birds? It is possible too that some of the waders counted in April did not stay to breed in those tetrads but the high counts of Lapwing *Vanellus vanellus*, Curlew *Numenius arquata* and Snipe *Gallinago gallinago* in April could also be because those birds were most active and vocal then. In the above analysis, the 11 Ring Ouzels and 12 Redpolls have been taken out. If counts are made in April they are best done later in the month when such anomalies are less likely and also a higher proportion of species will be found.

In June, especially later in the month, birds such as Starling, Rook *Corvus frugilegus* and Swift would appear, sometimes in substantial numbers, in tetrads where they had not previously been recorded and probably did not breed. Many of these birds would be juveniles, which should not be counted anyway. I was careful that I only counted adult birds in flocks of Rooks and Starlings but that was not practically possible in the post-breeding flocks of Jackdaws *Corvus monedula* and Meadow Pipits *Anthus pratensis* so their numbers in June must surely have been inflated by juveniles. Again, the above figures were adjusted to ignore birds that I thought were not breeding in each tetrad. These issues can be avoided to some extent if the June counts do not continue into the later part of the month.

Even in May some birds proved to be surprisingly elusive, including Great Spotted Woodpecker *Dendrocopus major* (21% of the highest count), Pied Wagtail *Motacilla alba* (45%), Goldcrest *Regulus regulus* (27%), Coal Tit *Periparus ater* (36%), Nuthatch *Sitta europaea* (20%), Treecreeper *Certhis familiaris* (35%) and Jay *Garrulus glandarius* (19%). It is likely that a survey done entirely in May could produce surprisingly low numbers of these birds.

Is this why Goldcrest, Coal Tit, Treecreeper and Jay were all reported to be surprisingly scarce in SK29 in May 2016 (Gosney 2018d)? Maybe not. Their numbers were being compared with the results for 1988-90 when most of the 'best counts' used in the analysis were also done in May. The counts made in April or June 1988-90 did not particularly impact on the overall numbers of Goldcrest, Coal Tit or Treecreeper. However, perhaps significantly, half of the 8 Jays reported in SK29 in 1988-90 were found during the 3 April counts. So, does this also account for the relative lack of Jays counted in SK27 in May 2017 (Gosney 2018e)? No, because 11 of the 13 Jays counted in 1988-90 had also been reported in May.

It is important to remember that the aim of these surveys is to produce a measure of abundance for each bird that is generated using a defined amount of effort and can therefore be repeated for comparisons in future years. This can be achieved without finding every species in every tetrad. Provided the counts are done by observers of equal competence, useful results can be obtained using just 1 one-hour count per tetrad. Even in May, nearly half the birds will be missed on each visit and several will be under-counted but, if the survey is repeated in May, the 'overlooked' and 'under-counted' birds should be equally 'overlooked' and 'under-counted' in both surveys.

The trouble is that when so many birds are being overlooked or under-counted this introduces a randomness in the data which could account for at least some of the differences when these data are analysed. These data will suffer from much less variability if the best of two counts per

tetrad can be used (or if the results of a larger number of tetrads are aggregated).

If two months' data are combined then the best of those two counts would be more than 80% of the overall highest – regardless of which 2 months are chosen – and the number of under-recorded birds falls to just a handful, as follows:

April and May combined left 4 species under-recorded: Grey Heron *Ardea cinerea* (44%), Common Sandpiper (44%), House Martin (43%) and Spotted Flycatcher (36%). These are birds for which the June data were most important.

April and June combined left 6 species under-recorded: Oystercatcher (33%), Cuckoo *Cuculus canorus* (38%), Wheatear (36%), Garden Warbler *Sylvia borin* (33%), Pied Flycatcher *Ficedula hypoleuca* (41%) and Crossbill *Loxia curvirostris* (45%). These are birds for which the May data were most important.

May and June combined left no birds under-recorded (by this measure at least). There were none for which the April data were the most important.

So, May and June seem to be the best option but, as described above, counts in late June can give misleading numbers of some birds. Maybe the best advice is to make sure that there are two counts within the period 20 April to 20 June (say one before 20 May and one after) as this would:

a) Provide an opportunity in the second count to pick up birds that had been missed in the first and therefore give a more complete species list;
b) Provide a spread of counts over a two month period so that birds that are under-recorded in one count might be found in more representative numbers in the second;
c) Limit the risk of inappropriate birds being counted because they are either winter visitors, juveniles or wandering post-breeders.

This analysis suggests that 2 counts done in May-June could produce an aggregate 73% of the 'expected species', each counted at, on average, 85% of their 'highest count'. Of course, three 1-hour counts for each tetrad would give even more comprehensive coverage but involves 50% more effort and only a limited gain.

Aim 3. Distribution maps from TTVs?

Could these 1-hour TTVs also be used to replace the currently popular distribution surveys in which observers have unlimited time over several years to list the birds in every tetrad? That depends on what percentage of the 'expected species' is considered to be acceptable. In this survey, two hours of TTVs in a tetrad produced on average 73% of the birds (76% of diurnal ones) found by SBSG in its 'unlimited time' survey. Would it be acceptable to produce distribution maps in which about 25% of the birds had been missed in each tetrad?

It should be appreciated that this figure of 'only' 73% is in comparison with an unlimited time survey in which the coverage was exceptional. In the next square to the north, SK29, the SBSG coverage was so thorough that a survey in 2006-11 by the Barnsley Bird Study Group produced, on average, only 86% of the SBSG total, despite the fact that observers were asked to spend at least 13 hours in each tetrad (Pearce & Middleton, 2019). In the next square to the south,

SK27, an unlimited time tetrad survey by the Derbyshire Ornithological Society over 5 seasons in 1995-99 (Frost & Shaw, 2013) only achieved 85% of the SBSG total. If some unlimited time surveys only reach 85% of the total, then my figure of 73% in two hours seems more acceptable as the basis for a distribution survey too. Note that in areas which had previously been less comprehensively covered it would be easier to achieve a higher percentage of the total. For example, to the east of Sheffield, where the SBSG coverage was less exceptional, I surveyed 14 tetrads during 2008-11 and managed to find 84% on average of the SBSG total in just 2 TTVs per tetrad.

However, 3 hours of counts would be even better if the aim is to produce a comprehensive species list for each tetrad. By increasing the time spent to 3 hours per tetrad, 82% of the expected birds were found (86% of diurnal ones) even when compared with an exceptionally thorough unlimited time survey. If we mapped those results how many birds would be badly represented and which were the ones most often missed?

For each bird in SK28 I looked at how many tetrads it was recorded in during the 3 1-hour TTVs in 2020 and compared it with how many tetrads it had been found in during the unlimited time survey of the SBSG during 2003-08. 34 birds were found in 100% or more of the tetrads where they had been found during 2003-08. A further 23 were found in at least 75% as many tetrads. That leaves 34 birds that were found in less than 75% of the tetrads and a further 12 which were not found at all in the 75 hours.

Of course, some of these differences will be due to changes in distribution since the 2003-08 survey over 10 years ago. Species found in more tetrads included birds like Buzzard *Buteo buteo*, Mandarin Duck *Aix galericulata* and Greylag Goose *Anser anser* which had spread to new areas. The ones which were not found at all included some which were probably, maybe even certainly, not present in SK28 in 2020 (Red-breasted Merganser *Mergus serrator,* Dunlin *Calidris alpina*, Redshank *Tringa totanus*, Short-eared Owl *Asio otus*, Lesser Spotted Woodpecker *Dendrocopus minor,* Willow Tit *Poecile montana* and Yellowhammer *Emberiza citrinella*). That leaves 4 birds that were certainly missed during the TTVs (Little Grebe *Tachybaptus ruficollis,* Little Ringed Plover *Charadrius dubius* and two nocturnal birds, Little Owl *Athene noctua* and Nightjar *Caprimulgus europaeus*) and another that may have been overlooked (Sedge Warbler *Acrocephalus schoenobaenus*, which has not yet been proven to breed in SK28). The rest that were found in less than 75% of the tetrads are listed in Table 3 (excluding nocturnal ones such as Tawny Owl and Woodcock). There could be two reasons why any of these birds were found in fewer tetrads: either they were overlooked in many tetrads or they were not there because they had declined. The final column expresses my opinion on which of these was most likely. I've tried to give evidence for this opinion by also showing a) how much they had declined, based on the TTV counts in 2020 compared with similar counts in 1988-90 (note this represents a much longer time period), and b) how likely they were to have been overlooked. A bird is considered to be easily overlooked if it has a low 'detectability rate'. We can get a measure of this by looking at how often a bird` is not found even in those tetrads where it is known to occur. For example, Skylark *Alauda arvensis* was found in 21 tetrads so should have been counted during all 63 TTVs carried out in those tetrads. In fact it was counted in 52 (83%) of those visits so is said to have a 'detectability rate' of 83% - ie. it was found on 83% of the visits in those tetrads in which it was known to occur. (For this calculation I included all the tetrads where a bird had been found (by me) in April-June 2020, even if some of those records were

outside the TTVs. Some of the summer migrants might have had a higher detectability rate if the calculation had not included the April counts made before that species arrived.)

Table 3. Species which were found in SK28 in 2020 in fewer than 75% of the tetrads which had been occupied during 2003-08, despite 3 1-hour visits to each tetrad. This could be because they were no longer there (suggested by decline since 1988-90) or were overlooked (suggested by low detectability rate).

Species	% of occupied tetrads cf 2003-08	Decline since 1988-90	Detectability rate	Declined since 2003-08 or overlooked
Whinchat *Saxicola rubetra*	6%	-92%	100%	Declined
Green Woodpecker	8%	-80%	33%	Declined (and overlooked?)
Coot	14%	-67%	33%	Declined
Dipper *Cinclus cinclus*	15%	0%	33%	Overlooked
Sparrowhawk *Accipiter nisus*	19%	-33%	28%	Overlooked
Grasshopper Warbler	29%	new	13%	Overlooked
Goosander	33%	new	33%	Declined (since 03-08)
Grey Partridge	33%	+50%	19%	Overlooked (and declined?)
Swift	35%	-58%	25%	Declined
Wood Warbler *Phylloscopus sybilatrix*	43%	-72%	67%	Declined
Lesser Redpoll	44%	-70%	43%	Declined (and overlooked?)
Tree Pipit *Anthus trivialis*	45%	-38%	64%	Declined
Wheatear	47%	-53%	30%	Declined (and overlooked?)
Grey Heron	0%	-67%	39%	Overlooked
Stonechat *Saxicola torquatus*	50%	+1800%	56%	Overlooked (and declined?)
Golden Plover *Pluvialis apricaria*	53%	+17%	50%	Overlooked (and declined?)
Garden Warbler	58%	+129%	41%	Overlooked
Oystercatcher	60%	new	42%	Overlooked
Magpie *Pica pica*	62%	+11%	75%	Declined
Cuckoo	63%	+11%	41%	Overlooked
Ring Ouzel	64%	+36%	70%	Possibly both
Long-tailed Tit *Aegithalos caudatus*	65%	+250%	38%	Overlooked
Reed Bunting *Emberiza schoeniclus*	65%	+57%	58%	Overlooked
House Sparrow *Passer domesticus*	69%	-3%	53%	Overlooked

Feral Pigeon *Columba livia*	70%	+450%	33%	Overlooked
Jay	71%	+250%	33%	Overlooked
Tufted Duck *Aythya fuligula*	71%	-33%	33%	Declined (and overlooked?)
House Martin	72%	-73%	36%	Overlooked
Great Spotted Woodpecker	74%	+100%	44%	Overlooked

This shows which birds are most likely to be overlooked if only 3 hours of visits are made but note that most of them were still found in more than half of the tetrads where a more thorough survey had found them to be present. Of those that were found in less than 50%, most had obviously declined apart from a few that were clearly overlooked, notably Grasshopper Warbler, Sparrowhawk and Dipper (and nocturnal ones, not listed here). Others (Green Woodpecker, Grey Partridge, Lesser Redpoll and Wheatear) had also declined but may have been overlooked too to some extent. Remember that 57 species had been found in at least 75% as many tetrads as in the unlimited time survey. I am suggesting that if at least 3 TTVs are carried out in each tetrad the results are almost comparable to an exceptionally thorough unlimited time survey, with just a few species under-represented.

For interest, the other (diurnal) species with a low 'detectability rate' (less than 50%) were Tree Sparrow *Passer montana* (27%), Red-legged Partridge (33%), Kingfisher (33%), Sand Martin (33%), Lesser Whitethroat (33%), Spotted Flycatcher (33%), Raven *Corvus corax* (33%), Crossbill (33%), Buzzard (39%), Common Sandpiper (40%), Starling (40%), Rook (43%), Kestrel *Falco tinnunculus* (46%), Collared Dove *Streptopelia decaocto* (46%), Goldcrest (46%), Grey Wagtail *Motacilla cineraea* (48%), Pied Flycatcher (48%) and Treecreeper (48%). These are not included above because, despite being found rather unpredictably, they were still located in over 75% of the tetrads that were known to be previously occupied.

Discussion

Given adequate coverage, a standard 'tetrad atlas' or distribution survey has the benefit of providing definitive data; species are either present or absent in each tetrad. When compared with similar surveys done in previous years they can show changes in the number of occupied tetrads which reflect changes in the local bird populations. But abundance surveys, counting each species using TTVs, show more clearly differences in bird numbers over time and across an area. They also require considerably less effort, so results are achievable using fewer observers and in a shorter time and, providing the observers are of similar ornithological competence, they are based on fixed amounts of effort and so should be directly comparable.

Gosney (2018d and 2018e) has shown that one observer can cover a 10km square in just one year or even one week if just a single 1-hour visit is made to each tetrad in May. But such an approach yields, at best, just 55-60% of the birds present on each visit. The more visits that are made to each tetrad, the easier it becomes to get a more representative number for each species. However, Gosney 2020 has shown the importance of using only experienced observers, so this paper seeks to find an amount of effort that is easily achievable by just a few observers and yet manages to find a significant proportion of birds and a representative count of each of them.

The data presented here suggest that if a competent observer makes two 1-hour visits to each tetrad, one in May and one in June, he or she is likely to find about 75% of the species present (a higher proportion if you exclude nocturnal birds and 'one-offs') and, using the best of those counts for each bird will yield a representative number for all but a few of them.

This approach of two TTVs during the breeding season is similar to that recommended by the British Trust for Ornithology (BTO) but it suggests one in April/May and another in June/July. If an observer following this protocol chooses to make one count in April and the other in June or July then no count is made in May, the best month for most birds. Also, if the counts are made in early April or after mid-June then the numbers of some birds could be misleading. Visits in June/July may be invaluable if, as in the BTO surveys, observers are also asked to look for proof of breeding but for the most comprehensive species list and the most representative count of each bird, May and June makes a better combination, or, better still, late April to mid-June.

Conclusion

This paper advocates the benefits for local studies of using Timed Tetrad Visits to generate data on the abundance of birds in each tetrad, rather than just their presence or absence. The flaws in this methodology can be mitigated if two TTVs per tetrad are carried out in each season, one in May and one in June by only the most competent observers. This can yield a species list for each tetrad that includes about 75% of the birds that might be found by a more time-intensive survey and leaves none significantly under-counted. Using this approach, it is still possible, with some effort, for an observer to cover a hectad (10 x 10 km) in a single season – 50 hours, spread over 2 months. This means that an area with, say 300 tetrads (12 hectads), could be covered by 12 competent observers in a single year or a team of 6 observers in 2 years. This could yield publishable results within 1-2 years of the start of the survey. Such a survey could be easily repeated at regular intervals (say, every 5 or 10 years) to give local bird societies a more detailed, more directly comparable and more timely picture of what is happening to their bird populations.

If the aim is to compare the number of occupied tetrads with a previous 'unlimited time' survey then at least 3 TTVs would be required and, even then, some birds, eg Sparrowhawk, Dipper and Grasshopper Warbler, would still be relatively over-looked. Realistically, this would take most observers two years per hectad, in which case maybe the second year should be devoted to targeting the missing birds, including nocturnal ones, but still using a clearly defined number of timed visits.

References

Frost, R. & Shaw, S., (2013) *The Birds of Derbyshire*. Liverpool University Press, Liverpool.

Gosney, D. (2018a) The 1988-90 Sheffield Tetrad Bird Count Survey. *Sorby Record* 54: 35-50.

Gosney, D. (2018b) A survey of nightbirds in SK29 (Stocksbridge) - a baseline and protocol for future studies. *Sorby Record* 54: 5-18.

Gosney, D. (2018c) A survey of Nightjars and Long-eared Owls in SK29 (Stocksbridge) in 2018 with observations of increased numbers of Barn Owls. *Sorby Record* 54: 18-23.

Gosney, D. (2018d) Breeding birds in SK29 in 2016 - changes in numbers since 1988-90. *Sorby Record* 54: 22-28.

Gosney, D. (2018e) Breeding birds in SK27 in 2017 - changes in numbers since 1988-90. *Sorby Record*

54: 29-34 .
Gosney, D. (2020) Breeding birds to the west of Sheffield – are the reported declines just an artefact caused by differences in observer competence? *The Naturalist* 145: 188-195.
Pearce, D. M. & Middleton, P. (2019) *Atlas of Breeding Birds in the Barnsley Area.* Barnsley Bird Study Group
Wood, D. & Hill, R. D. (2013) *Breeding Birds in the Sheffield Area.* Sheffield Bird Study Group, Sheffield.

The Mycoflora of drystone walls & use of DNA metabarcoding

Michael Pearson Austwick Hall, Austwick, Via Lancaster, LA2 8BS
Email: info@austwickhall.co.uk

Introduction

The use of environmental DNA is increasingly seen as an important technique in the study of natural history. It has moved beyond the determination of the presence or absence of great crested newts in ponds to the identification of a wide range of other taxa (Tang *et al,* 2018). For example, the technique has been used for entomological recording at Potteric Carr (Horsfall, 2019) and the study of the fish communities of the River Frome (Naturemetrics, 2018).

In a recent investigation DNA metabarcoding was used to determine the lichen diet of the Common *Eilema lurideola* and Muslin Footman *Nudaria mundana* moths by an analysis of caterpillar frass (Pearson, 2020). Based on a preliminary survey of the lichens growing on a drystone wall it had been anticipated that perhaps fifteen species of lichens would be identified from the faecal samples. However, the DNA analysis identified nearly 100 genera of fungi, of which nine were lichens. This present paper examines the diversity of the mycoflora and possible limitations to the use of DNA metabarcoding.

Method

Caterpillars (see Figure 1, p20) of the two species were collected daily in separate containers from the walls of Townhead Lane, Austwick, between 12 May and 10 June 2019. They were released after twelve hours and the frass deposited in the containers was then stored until sufficient (200mg) material for DNA analysis had been collected. In total 130 Common and 226 Muslin Footman caterpillars were collected. The latter are smaller and produce less faecal material hence the difference in sample size. The frass was analysed by AllGenetics, a specialist genomics laboratory. The DNA was isolated and the metabarcoding libraries were prepared using primers to amplify the ITS2 genome region for fungi. The sequences were then compared against the UNITE reference database for taxonomic identification (AllGenetics).

Results

The DNA analysis retrieved a total of 537 unique ITS2 sequences or amplicon sequence variants which were assigned to 99 different fungal genera but only 72 species. This discrepancy arises when a sequence was not found in the reference database. In other words, not all fungal species have undergone DNA analysis and so the reference database is not comprehensive. Even when

the species cannot be fully resolved, it is usually possible to assign the DNA sequence to the level of genus, based on the identity of the most similar reference sequences.

Table 1 (p22) is a summary of the genera and species identified in the frass of both species. Where a genus is listed as well as a species of that genus it means that two species of fungi were present in the frass but only one of them could be identified with certainty. It is possible that in future, when more DNA material is included in the reference database, that the 'missing' species could be identified.

The British Isles are amongst the most thoroughly recorded areas for fungi. Yet the ecology, life histories, physiology etc. of our native mycota are for the most part little known. So, to analyse the data it was decided to divide the fungal species into several broad categories. These are not exclusive in that, for example, the gut fungi identified is also a yeast. In some instances it was not possible to assign a fungus to a group through lack of data. The lichens, lichenicolous fungi, insect pathogens and gut symbionts were reported in the earlier paper (Pearson, 2020) but are also included in Table 1 (p22).

Macrofungi:
The fruit bodies of these fungi are only occasionally found on drystone walls. The only one so far identified was the small brown mushrooms of *Galerina* which was found growing on moss. The DNA of this genus was not identified from the caterpillar frass. In total 13 genera of macrofungi were found and 12 of these at a species level. However, it is uncertain whether these macrofungi live on walls but do not produce fruit bodies or whether they are simply spores which settle on the wall surface but do not survive to establish themselves.

Xerotolerant fungi:
Whilst many of us associate fungi with damp habitats there are some species that tolerate and even thrive in drier conditions. Among this group are members of the genera *Aspergillus*, *Penicillium*, *Wallemia*, *Coniosporium* and *Knufia*. Some species have been isolated from limestone (e.g. *Aureobasidium pullulans*) whilst other yeasts have been identified growing on marble monuments in Italy (Isola *et al.*, 2015). In the case of the Italian study, *Vermiconia calcicola* was isolated from a marble monument in the cemetery of Bonaria and was only DNA sequenced in 2015. It was identified also in the frass of the Muslin Footman.

Saprotrophic fungi:
Drystone walls may seem to be barren structures but in fact they do contain dead or decaying organic matter within them. It is thus possible that these fungi live on the walls. It cannot be discounted that the spores of these fungi have drifted from the wider environment. The DNA from at least 54 saprotrophic fungal species was identified from the frass.

Yeasts:
Although some yeasts feed on decomposing material there have been a few studies investigating their presence in the gut flora of insects. From the DNA analysis 24 species of yeasts were isolated. Again, it is unclear whether these single-celled organisms are part of the wall flora or could be viewed as contaminants.

Plant pathogens:
Drystone walls are often colonised by ferns and flowering plants so it is not surprising that

fungal pathogens are also present. For example, the DNA of *Melanconium hedericola* was isolated, a micro-fungus, which grows on ivy. This was found in the frass of both caterpillars.

Contaminants:
Some of the fungi identified are associated with human skin or nails. This may suggest that their presence could have been a result of contamination when collecting the caterpillars. Whilst this is possible it is not clear from the published reports whether these fungi also live on smaller mammals and birds, both of which are associated with drystone walls. *Exophiala attenuata* DNA appeared in both species of moth. There were other fungi which live on dung. Again, it is not clear whether these have colonised the frass once it had been collected or picked up incidentally by the caterpillars.

Figure 1. Common Footman larva. *Photo:* Dave Williamson

Discussion

In planning the investigation it had been anticipated that the fungi identified would be limited to those of the lichens. In fact this was only the tip of the iceberg with many other species adapted in different ways to life on drystone walls. The fungi are an extremely varied group. The lichens, a symbiosis of a fungus with an alga or cyanobacterium, are adapted to a broad range of environments including many which could not be tolerated by either one of the partners living alone. Other of the fungi are in mutualistic relationships, for example the gut flora, as well as parasitic ones in the case of the pathogens. Then there were those fungi which are specifically adapted to living in dry conditions. Finally, the mycoflora may contain spores which have been dispersed by fungi living in the surrounding environment, which may or may not succeed and develop in the wall. It is evident that the mycoflora of drystone walls is complex.

The identification of lichens may be difficult but it would have been near impossible to have named the rest of the genera and species without DNA analysis. In fact, at least one (*Vermiconia calcicola*) was only identified through DNA sequencing. The success of DNA metabarcoding, as a technique, has been the ability to detect minute quantities of DNA. However, this also highlights the presence of fungi which may be viewed as contaminants.

In studying the diet of the Footman moths it was not always possible to distinguish between those fungi selected by the caterpillars as food and those species that are eaten by chance i.e.

those species that are so small that they are consumed simply because they have settled on the lichens. The passage through the invertebrate gut is an important method of dispersal for many fungi (Spooner & Roberts, 2005).

Another source of contaminants may have been those picked up by the caterpillars as they walked across the stone surfaces. Fungal spores may have been attached to the caterpillar feet and bodies which were then transferred to the collecting containers. Another possibility is that fungal spores colonised the frass while it was being stored, before despatch to the laboratory. It is unlikely that these sources of contaminants can be avoided when collecting live specimens from the field.

Clearly the use of DNA metabarcoding has great potential to contribute to the study of natural history. It is a powerful technique, still in its infancy, which continues to develop. For example, work is underway to explore how the frequency of sequences isolated can be converted into estimates of abundance of species in a sample (Matesanz *et al*., 2019). Such developments can only enhance the interpretation of the raw data.

Conclusions

Drystone walls may appear to be a sterile habitat which is challenging to all forms of life. However, DNA analysis of caterpillar frass demonstrates the diversity of the fungi associated with walls. Unfortunately, it is not possible at present to distinguish between those species which are 'permanent' as opposed to those which may be present as air-borne spores which develop no further.

Acknowledgements

The Linnean Society, through the Appleyard Fund, provided generous support for the project. Dr Veronica Rojo, of Allgenetics, helpfully answered my many questions and provided further explanations of the DNA analysis.

References

AllGenetics & Biology SL (www.allgenetics.eu) *Dietary analysis of caterpillar faeces using DNA metabarcoding*. Project CaterpiMet Report 14/2/20

Horsfall J. (2019) A report on the use of DNA metabarcoding for entomological recording at Potteric Carr. *The Naturalist* 144: 32-38

Isola D., Zucconi L., Onofri S., Caneva G., de Hoog G. & Selbmann L. (2015) Extremotolerant rock inhabiting black fungi from Italian monumental sites. *Fungal Diversity* 76.10.1007/sl 3225-015-0349-9

Matesanz S., Pescador D. S., Pias, & Sanchez A. M. (2019) Estimating belowground plant abundance with DNA metabarcoding. *Molecular Ecology Resources* 19: 1265-1277.

Naturemetrics (2018). *Fish communities of the River Frome*. Accessible at: https://www.naturemetrics.co.uk/fish-communities-of-the-river-frome/

Pearson, M.B. (2020) The use of DNA metabarcoding in studying the diet of two lichenivorous moths. *The Naturalist* 145: 199-203

Spooner, B. & Roberts, P. (2005) *Fungi*. London: HarperCollins

Tang, C.Q, Crampton-Platt A., Townend S., Bruce K., Bista I. & Creer S. (2018) *Development of DNA applications in Natural England 2016/2017*. Natural England Commissioned Reports, No. 252.

Table 1. The fungal DNA isolated from the frass of Common and Muslin Footman caterpillars.

Key:

Ent	Gut fungus	F	Faecal feeder	HC	Human contaminant
IP	Insect pathogen	L	Lichenicolous	Lich	Lichen
M	Macrofungus	PP	Plant pathogen	S	Saprotrophs
X	Xerophytic	Y	Yeast		
?	Uncertain category, or many categories within genus				
+	Fungal DNA identified (No. of +s indicates number of possible unidentified species detected)				

Fungal Taxa	**Common Footman**	**Muslin Footman**	**Fungal Category**
Acremonium hennebertii	+		S
Agaricus		+	M
Aspergillus cibarius	++		X
A. conicus	+		X
Athrocatena tenebrio		+	?
Aureobasidium pullulans	+	+	X
Bacidia	+		Lich
B. arnoldiana		+	Lich
B. sulphurella		+	Lich
Bannoa syzygii		+	Y
Bannozyma		+	Y
Beauveria	+		IP
Biatriospora	+		?
Blastobotrys buckinghamii	+		X
Buckleyzyma aurantiaca	+	+	Y
Bullera crocea		+	Y
Candelariella coralliza	+	+	Lich
Candida		+	X
Capronia (2 species)	++	++	S
Ceratobasidium		+	M
Chaetomium		+	S?
Chaetothyrium	+	+	?
Cheilymenia theleboloides		+	F
Chromocyphella muscicola	+	+	M
Cladophialophora (5 species)	+++	+++++	L
C. parmeliae	+	+	L
Cladosporium (2 species)	++	+	PP/S
C. tenuissimum	+	+	PP/S
Coniosporium (2 species)		++	X
Coniozyma leucospermi	+	+	PP?
Coprinellus micaeeus		+	M
Coprinopsis acuminata		+	M
C. atramentaria	+		M
C. clastophylla		+	M
C. stercorea		+	M
Coprinus cordisporus	+		M
Crocicreas		+	PP
Cryptococcus (3 species)		+++	Y
Cyphellophora		+	?
C. europaea		+	HC
C. olivacea		+	PP?
Cystobasidium slooffiae		+	Y
Cystofilobasidium capitatum	+	+	Y
Debaryomyces		+	?
Devriesa fraserae	+	+	?
Didymella	+		PP
Dioszegia takashimae		+	Y
Dothiorella (2 species)	+	++	PP
Exophiala attenuata	+	+	HC
Filobasidium wieringae		+	Y
Fusarium (3 species)	+	+++	S
F. domesticum	+	+	?

Fungal Taxa	Common Footman	Muslin Footman	Fungal Category
Fusicolla (2 species)	++	+	?
Ganoderma adspersum		+	M
G. australe		+	M
Geomyces auratus		+	HC?
Gibberella palicaris	+		PP
G. tricineta	+	+	PP
Gibellulopsis piscis	+	+	S?
Gregarithecium curvisporum		+	?
Holtermanniella takashimae		+	Y
Hyalorbilia erythrostigma	+		PP
Knufia (2 species)	+	++	X
Kockovaella		+	Y
Lecanicillium		+	Ent
Lecanora hagenii		+	Lich
L. polytropa	+		Lich
Lecidella	+	+	Lich
Lycoperdon pyriforme		+	M
Martierella camargensis	+		S
M. riskikesha		+	S
Melanconium hedericola	+	+	PP
Microascus longirostris		+	PP?
M. paisii	+		PP?
Muakiella aquatica		+	Y
Mucar hiemalis	+	+	PP
Nigrograna	+		S
Ovadendron sulphureoochraceum	+		?
Panaeolus fimicola	+	+	M
Papiliotrema	+	+	Y
P. terrestris	+	+	Y
Parasola hercules		+	M
Parmelia	+	+	Lich
Penicillium (5 species)	++	++++	X?
P. mexicanum	+	+	X
P. spathulatum	+	+	X
Phaeophyscia orbicularis	+	+	Lich
Podospora pleospora	+		S
Preussia flanaganii	+	+	F
P. persica	+	+	F
P. tetramera		+	F
Pseudogymnoascus appendiculatus	+		S
Pyrenochaeta	+		S
P. keratinophila	+	+	HC
Rhinocladiella (8 species)	+++	++++++	?
Roussoella (3 species)	+	++	PP?
Sarocladium (2 species)		++	S
Scoliciosporum chlorococcum	+	+	Lich
S. umbrinum	+	+	Lich
Scopulariopsis candida		+	S?
Scutelinia scutellata	+		S
Sirobasidium brefeldianum		+	Y
Sordaria fimicola	+	+	F
Sugitazyma miyagiana		+++	Y
Suillus granulatus		+	M
Taphrina	+		M
Tausonia pullulans	+	+	Y
Thelebolus (2 species)	++	++	F?
Tolypocladium (4 species)	++++	+++	IP
Trechispora		+	HC?
Trichoderma	+		?
Trichomerium dioscoreae (6 species)	+++	++++++	PP?
Umbelopsis angularis		+	?
U. isabellina	+	+	?
Ustilago nunavutrea		+	PP
Vermiconia calcicola		+	X
Veronaea		+	?
Vishniacozyma	+	+	Y
V. heimaeyensis	+	+	Y
V. victoriae	+	+	Y
Wallemia	+		X
W. muriae	+		X
Xanthoria parietina		+	Lich
Xlaria fecjeensis		+	M

The current distribution of *Electrogena affinis* (Eaton, 1885)

Craig R. Macadam[1], **Andrew Farr** and **David Croft**
Buglife – The Invertebrate Conservation Trust, Balallan House, 24 Allan Park, Stirling, FK8 2QG.
[1]Email: craig.macadam@buglife.org.uk

Introduction
In Europe *Electrogena affinis* (Eaton, 1885) (Figure 1 & 2) has been recorded from lowland reaches of larger rivers where it is found on deadwood and amongst submerged roots in areas of slower flow (Bauernfeind & Moog, 2000; Haybach, 1996; Haybach & Belfiore, 2003). Blackburn *et al.* (1998) reported the discovery of this mayfly, new to the British Isles, in the River Derwent at Norton, North Yorkshire, in 1988 and 1994, where they associated it with emergent and midstream vegetation in deep water. In subsequent years there were no further records of this insect.

Figure 1. Larva of *Electrogena affinis*

Figure 2. Subimago of *Electrogena affinis*

Fresh specimens of *E. affinis* larvae can be readily separated from *E. lateralis,* the only other British *Electrogena* species, by the presence of light patches along the front of the head (Figure 3). In *E. lateralis* the front of the head is uniformly coloured. Further features to separate the species are found on the legs. The ventral edges of the femora have fringes of fine setae in *E. affinis* (Figure 4); in *E. lateralis* there are only a few isolated setae. The tarsal claws of *E. affinis* have two to five small teeth (Figure 5); *E. lateralis* only has single teeth.

Electrogena affinis was classified as Data Deficient in the latest status review (Macadam, 2016) due to the lack of records. This paper describes recent efforts to define the distribution of *E. affinis* in Yorkshire.

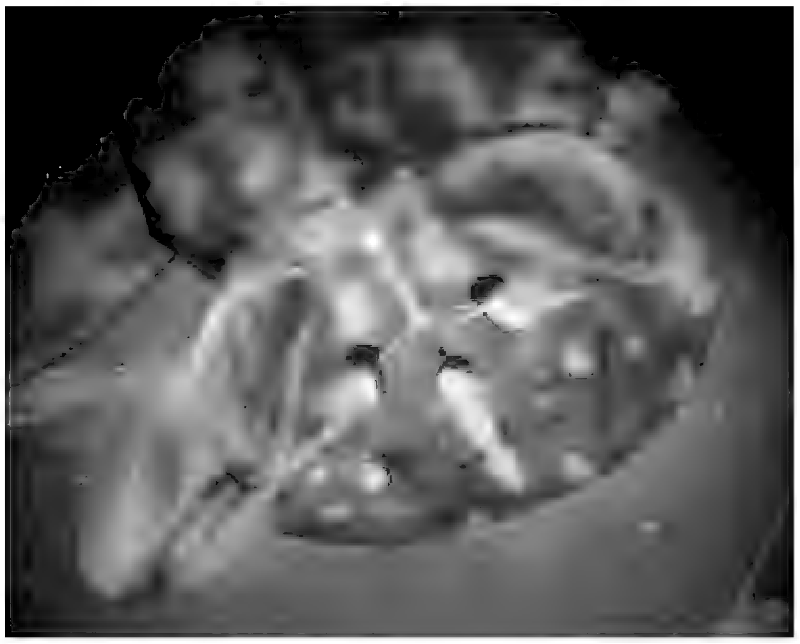


Figure 3. (left) Light patches on the front edge of head of *Electrogena affinis*.
Figure 4. (right) Middle leg of *Electrogena affinis* showing tarsal fringe of setae.

Figure 5. Teeth on tarsal claw of *Electrogena affinis*.

Methods

From 2016 to 2020 locations in the River Derwent catchment, Yorkshire, were visited immediately prior to and at the start of the flight period (July to August) (Blackburn *et al*., 1998). *Electrogena affinis* is associated with submerged wood and emergent vegetation (e.g. Reed Sweet Grass *Glyceria maxima*) in areas of deep, slack marginal water (Bauernfeind & Moog, 2000). It has also been collected from mid-stream in faster-flowing, deep water where it is found on pondweeds *Potamogeton* spp. (Blackburn *et al.* 1998). It does not appear to be present on bare substrates (gravels, silts, sand, etc.) and may not be collected by standard kick sampling methods. Instead, a standard FBA pattern hand-net was used to collect invertebrates from the substrate and submerged and emergent vegetation by sweeping the net through the water, disturbing and dislodging any invertebrates present.

The resulting sample of invertebrates mixed with plant material, mineral particles and detritus was placed in a large white tray and sorted on the bankside. Specimens of Heptageniidae were retained and identified using appropriate taxonomic keys (Eiseler, 2005; Elliott & Humpesch, 2010).

Results

Twenty-five locations on the River Derwent and 11 locations on the River Rye were investigated. In addition, the Pocklington Canal immediately upstream of its confluence with the River Derwent, Costa Beck at Pickering Low Carr Farm and the River Ouse at Nether Poppleton were also investigated.

Electrogena affinis was recorded from a 26 kilometre stretch of the River Derwent from Rye Mouth to Stamford Bridge and from the River Rye between Swinton and Ryton (Table 1). It was not found at the site of its original discovery; however, access to the river here was difficult and a more thorough search may subsequently find this mayfly there. Searches of the River Derwent upstream of Ryemouth and downstream of Stamford Bridge and of the River Rye upstream of Swinton did not provide any specimens of *E. affinis*. None were found in either the Pocklington Canal or Costa Beck. Similarly, no specimens were recorded from the River Ouse at Nether Poppleton; however the river here is large and sampling from the bank is difficult.

Table 1. Locations sampled for *Electrogena affinis* between 2016 and 2020.
Recorders: AF = Andrew Farr, AM = Alan Mullinger, CM = Craig Macadam, DC = David Croft, DS = David Southall, JS = John Shannon, SC = Stuart Crofts.

River	Location	Grid Reference	Date	Present	Samplers
Derwent	Forge Valley just above weir	SE 9887 8573	30/07/2019	No	DS
Derwent	South of Brompton	SE 9322 7927	30/07/2019	No	DS
Derwent	Yedingham	SE 891 796	09/08/2016	No	AF
Derwent	Yedingham	SE 8924 7965	16/06/2017	No	DC, JS
Derwent	Just above Ryemouth	SE 8292 7576	18/07/2017	Yes	DC, JS
Derwent	Malton	SE 7856 7149	01/07/2016	Yes	SC, CM, AF, DS
Derwent	Malton	SE 7909 7143	13/07/2019	Yes	AF
Derwent	Norton	SE 7826 7130	01/07/2016	Yes	SC, CM, AF, DS
Derwent	Norton	SE 7825 7129	19/07/2018	Yes	AF
Derwent	Kirkham Priory	SE 734 657	08/08/2016	Yes	AF
Derwent	Kirkham Priory	SE 733 657	30/06/2016	Yes	AF
Derwent	Kirkham Priory	SE 733 657	18/07/2019	Yes	DC, JS
Derwent	Howsham Bridge	SE 732 625	08/08/2016	Yes	AF
Derwent	Howsham Bridge	SE 7324 6248	13/07/2019	Yes	AF
Derwent	Howsham Bridge	SE 732 625	18/07/2019	Yes	DC, JS
Derwent	Low Hutton	SE 7648 6766	19/07/2018	Yes	AF
Derwent	Low Hutton	SE 764 676	13/07/2019	Yes	AF
Derwent	Stamford Bridge	SE 711 555	07/08/2016	No	AF
Derwent	Stamford Bridge	SE 711 555	18/07/2019	Yes	DC, JS
Derwent	Below Stamford Bridge	SE 7102 5549	05/08/2019	No	DS, AM
Derwent	Below Stamford Bridge	SE 7084 5539	19/07/2019	Yes	DS, AM
Derwent	Below Stamford Bridge	SE 7084 5539	05/08/2019	Yes	DS, AM
Derwent	Below Stamford Bridge	SE 7106 5551	05/08/2019	No	DS, AM
Derwent	Below Kexby	SE 7066 5082	05/08/2019	No	DS, AM
Derwent	Wheldrake Ings	SE 6944 4446	05/08/2019	No	DS, AM
Derwent	Wheldrake Ings	SE 6945 4451	05/08/2019	No	DS, AM
Derwent	East Cottingwith	SE 6975 4242	05/08/2019	No	DS, AM

Derwent	East Cottingwith	SE 6975 6739	05/08/2019	No	DS, AM
Derwent	Scrayinham	SE 733 605	08/08/2016	No	AF
Derwent	Above Ryemouth	SE 8217 7583	18/07/2017	Yes	AF
Derwent	Barmby Barrage	SE 6808 2867	16/07/2020	No	DC, JS
Rye	Below Butterwick Bridge	SE 7337 7783	29/07/2019	No	DS, AM
Rye	Just below Newsham Bridge	SE 7484 7601	29/07/2019	No	DS, AM
Rye	North of Swinton	SE 7668 7514	14/08/2019	No	DS, AM
Rye	North of Swinton	SE 7675 7515	14/08/2019	No	DS, AM
Rye	North of Swinton	SE 7683 7610	14/08/2019	Yes	DS, AM
Rye	North of Swinton	SE 7693 7504	14/08/2019	No	DS, AM
Rye	North of Swinton	SE 7700 7499	14/08/2019	No	DS, AM
Rye	Above Ryton Bridge	SE 7829 7513	29/07/2019	Yes	DS, AM
Rye	Above Ryton Bridge	SE 7857 7529	29/07/2019	Yes	DS, AM
Rye	Just above Ryton Bridge	SE 7948 7534	29/07/2019	Yes	DS, AM
Rye	Ryton	SE 794 753	09/08/2016	Yes	AF
Rye	Newsham Bridge	SE 747 761	09/08/2016	No	AF
Costa Beck	Pickering Low Carr Farm	SE 7898 7908	29/07/2019	No	DS, AM
Pocklington Canal	Just above confluence with River Derwent	SE 7006 4271	05/08/2019	No	DS, AM
Ouse	Nether Poppleton	SE 557 550	07/08/2016	No	AF

Discussion

The River Derwent catchment has a unique Ephemeroptera assemblage which includes two Nationally Scarce mayflies (*Kageronia fuscogrisea* and *Brachycercus harrisellus*) and two Nationally Rare ones (*Caenis pseudorivulorum* and *Electrogena affinis*). Recent survey work has established that *Electrogena affinis* still occurs in the River Derwent and has been found over a range of 26 kilometres. In addition, it has been recorded in the River Rye at Ryton. It is estimated that the current Area of Occupancy (based on the methods described in IUCN (2019)) is 529.5km^2.

This insect appears to be restricted to small patches of emergent and marginal vegetation in deeper water. This is a fragile habitat which can be damaged or destroyed easily by inappropriate management activities. Any operations that affect the bed such as dredging, channel modifications or gravel removal could damage the habitat and should be avoided. Gross alterations to the aquatic vegetation structure, particularly weed cutting, may be detrimental to this species (Haybach *et al.*, 2003). Similarly, changes to the riparian habitat, whether through flood defence work or removal of bankside trees or inappropriate management of bankside vegetation may result in a loss of habitat for the adult insect.

In common with other Ephemeroptera, this species relies upon good water quality. Pollution events, whether persistent or catastrophic, could lead to the local extinction of this mayfly. High levels of suspended silt are likely to be particularly damaging to this and other mayflies. Considering the restricted Area of Occupancy, and being restricted to only two watercourses where potential threats may occur, it is likely that this insect may be classified as Vulnerable in a future status review. However, it is possible that it is surviving overlooked in other watercourses. In the Derwent catchment the presence of *Kageronia fuscogrisea* appears to be an indicator of

suitable conditions for *Electrogena affinis*. Other watercourses with *K. fuscogrisea* should be investigated, for example the Ouse, the Hull, the Thames and the Water of Cree, where suitable habitat is present.

Acknowledgements

The authors are grateful to East Yorkshire Rivers Trust for its support with these surveys and to Alan Mullinger, David Southall, John Shannon and Stuart Crofts for their assistance during the surveys. Figures 1 and 2 were provided by Stuart Crofts. All other Figures are by CRM.

References

Bauernfeind, E. & Moog, O. (2000) Mayflies (Insecta: Ephemeroptera) and the assessment of ecological integrity: a methodological approach. *Hydrobiologia* 422/423: 71-83.

Blackburn, J.H., Gunn, R.J.M. & Hammett, M.J. (1998) *Electrogena affinis* (Eaton, 1885) (Ephemeroptera, Heptageniidae), A Mayfly New to Britain. *Entomologist's Monthly Magazine* 134: 257-263.

Eiseler, B. (2005) Bildbestimmungsschlüssel für die Eintagsfliegenlarven der deutschen Mittelgebirge und des Tieflandes. *Lauterbornia*, 53, 1-112.

Elliott, J.M. & Humpesch, U.H. (2010) *Mayfly Larvae (Ephemeroptera) of Britain and Ireland: Keys and a Review of their Ecology.* Freshwater Biological Association Scientific Publication No. 66. 152pp.

Haybach, A. (1996) Zur Kenntnis der Eintagsfliegenfauna (Insecta: Ephemeroptera) von Rheinland-Pfalz - 2. Ergãnzungen und Korrekturen. *Lauterbornia,* 27: 11-20.

Haybach, A & Belfiore, C. (2003) Bestimmungsschlüssel für die Larven der Gattung (Insecta:Ephemeroptera Electrogena Zurwerra & Tomka 1985 in Deutschland :Heptageniidae). *Lauterbornia*, 46: 83-87.

Haybach, A., Schleuter, M. & Tittizer, T. (2003) Current distribution of mayflies (Insecta: Ephemeroptera) in German Federal Waterways, In Gaino, E. (ed.) *Research update on Ephemeroptera and Plecoptera*: 313-315. Università di Perugia. Perugia, Italy.

IUCN (2019) *Mapping Standards and Data Quality for IUCN Red List Spatial Data*. Version 1.18, International Union for Nature Conservation, Gland.

Macadam, C.R. (2016) *A review of the status of the mayflies (Ephemeroptera) of Great Britain – Species Status No. 28*. Natural England Commissioned Reports, Number 193.

Leaf-mining flies (Agromyzidae) new to the Yorkshire Diptera list : Part 3

Barry P. Warrington, National Agromyzidae Recording Scheme Organiser

221A Boothferry Road, Hessle, HU13 9BB, UK.

Email: agromyzidaeRS@gmail.com

Introduction

Following Warrington (2017, 2018, 2019), six species (one reinstated) of Agromyzidae are hereby added to the Yorkshire Diptera list. Five additions are based on collected adults, with one being reared from collected larval mines. One species is removed from the Yorkshire list.

A correction to the Yorkshire Diptera list is also included.

Additions

Agromyza macedonica Černý, 2011
Males were collected from a brownfield site in Hull, V. C. 61, 19.v.2020 and 21.v.2020 (Warrington 2021).

Liriomyza intonsa Spencer, 1976
A single male was swept from a brownfield site in Hull, V. C. 61, 19.v.2020 (Warrington 2021).

Ophiomyia senecionina Hering, 1944
Puparia were discovered on the stems of Common Ragwort (*Jacobaea vulgaris*) from various sites in East Yorkshire (V. C. 61), with adults being successfully reared.

Cerodontha vinokurovi Zlobin, 1994
Added to the British list by Warrington (2020) on the basis of material collected in Anlaby V. C. 61 during May 2020. Previously, this species was only known from the holotype [single female] collected in eastern Siberia.

Phytoliriomyza perpusilla (Meigen, 1830)
This species was added to the Yorkshire list (Warrington 2019) in error (see *The Naturalist* 145: 132) but is hereby reinstated. An adult male was sent to me by Tim Hodge for determination and examination of the male genitalia confirmed *P. perpusilla*. The adult was collected 13.ix.2019, Raincliffe Wood, V. C. 62.

Phytomyza paraciliata (Godfray, 1985)
Larval leaf mines on Ox-eye Daisy (*Leucanthemum vulgare*) were collected from a site in V. C. 61 during June 2020, which produced an adult male during the same month. This species may prove to be widespread within the county owing to the abundance of the host plant.

Exclusion

Chromatomyia fuscula (Zetterstedt, 1838)
This species was added to the Yorkshire list (Grayson 2018) on the basis of two males collected 23 April 2013 by John Coldwell. I examined a specimen [including male genitalia] during 2020 and it proved to be *Phytomyza fallaciosa* Brischke, 1881. The second specimen was re-examined by John Coldwell in light of my findings and was also confirmed as *P. fallaciosa*.

Correction

The following synonymy, published by V.V. ZLOBIN (2005. Studies on European species of the genus *Phytoliriomyza* Hendel (Diptera: Agromyzidae). *Russian entomological Journal* 14(2), 119-123), was overlooked in previous versions of the Yorkshire Diptera list:

Phytoliriomyza dorsata (Siebke, 1863) = *P. bornholmensis* Spencer, 1976

References

Grayson, A. (2018) Additions and corrections to the Yorkshire Diptera list (part 7): including two species of *Trichocera* [Diptera: Trichoceridae] new to the British list. *The Naturalist* 143 (1097): 23-30.

Warrington, B. P. (2017) Agromyzidae new to Yorkshire. *The Naturalist* 142 (1095): 149-150.

Warrington, B. P. (2018) Leaf-mining flies (Agromyzidae) new to the Yorkshire Diptera list. *The Naturalist* 143 (1097): 31-33.
Warrington, B. P. (2019) Leaf-mining flies (Agromyzidae) new to the Yorkshire Diptera list : Part 2. *The Naturalist* 145 (1103): 56-57.
Warrington, B. P. (2020) *Cerodontha (Xenophytomyza) vinokurovi* Zlobin (Diptera, Agromyzidae) new to eastern Europe, with first description of its male. *Dipterists Digest (Second Series)* 27, 193- 197.
Warrington, B. P. (2021) *Liriomyza intonsa* Spencer, 1976 (Diptera, Agromyzidae) new to England. *Dipterists Digest (Second Series)* 28, 102.

The effects of water level management on the breeding bird community of a wet lowland grassland and open water nature reserve

Jeff Lunn
Email: jeff.lunn@hotmail.com

Introduction
Wetlands are highly productive ecosystems supporting a vast diversity of wildlife as well as providing essential ecosystem services for mankind. Much has been written about the decline in wetlands worldwide through their drainage and reclamation or conversion to agriculture and industry with an estimated 35% decline worldwide since 1970 (Ramsar Convention on Wetlands 2018). Wetlands in the UK have followed a similar trend but many have been protected through legal designations and management agreements and there also has been much effort in restoring historic wetlands e.g. Thorne & Hatfield Moors in Yorkshire/north Lincolnshire (Lunn *et al*. 2011) and in creating new ones, particularly for birds e.g. at Lakenheath Fen (Sills 2017). The term 'wetlands' also encompasses a range of different forms, ranging from small ponds and springs to large lakes and reedbeds. This paper concerns 'wet lowland grassland' which is a broad wetland habitat type of low-lying meadows and pastures on floodplains subject to seasonal or occasional flooding, for instance one of the most important areas nationally is the Lower Derwent Valley National Nature Reserve in VC61 to the southeast of York (Milsom, 2006).

Such grasslands have long been of particular interest to conservationists and naturalists. Many centuries of careful management have evolved species-rich places with characteristic plant and animal communities. They have also been subject to intense conversion to other habitats such as arable or intense grass leys as the demand for hay has waned and intensively farmed crops are more profitable. They are now a scarce habitat in the UK, and have been the focus of much research and action in recent decades, with best practice well established through publications such as comprehensive handbooks (Crofts & Jefferson 1999), and an active national network, the Floodplain Meadows Partnership. (www.floodplainmeadows.org.uk).

Birds associated with wet lowland grasslands are some of our most charismatic species, especially waders such as Lapwing *Vanellus vanellus*, Snipe *Gallinago gallinago* and Redshank

Tringa totanus which have declined dramatically across the UK in recent decades, disappearing completely from large swathes of lowland southern England and Wales. Breeding population declines of Lapwing (-57%), Redshank (-44%) and range contraction of Snipe (-31%) over the last 25 years have resulted in them being placed on the UK's list of birds of conservation concern (Eaton *et al*., 2015, Woodward *et al*., 2020).

Associated with many wet grasslands are freshwater marshes, pools and lakes which also support breeding wildfowl such as Shoveler *Spatula clypeata*, Little Grebe *Tachybaptus ruficollis* and Mute Swan *Cygnus olor*. In an urbanised country such as the UK these places are also under pressure from recreational impacts such as fishing and boating as well as being magnets for general walking and dog walking such that much of the specialised bird fauna of lowland lakes and marshes is now confined to nature reserves.

Broomhill Flash

Bought in 2003 by the Garganey Trust, the 60 acres of Broomhill Flash nature reserve located on the River Dearne floodplain near Wombwell between Barnsley and Doncaster in southern Yorkshire, initially comprised a lake of 11 acres surrounded by cattle grazed pasture, and included a 12 acre arable field. As part of the renowned Wath Ings complex of sites it has been well known as an important site for birds for over half a century (Clegg 1962) and now forms part of the wider suite of wetland sites within the Dearne Nature Improvement Area (NIA) along with sites such as Old Moor (Capper 2019), Wombwell Ings and Edderthorpe Ings managed by the RSPB, and Denaby Ings and Carlton Marsh managed by the Yorkshire Wildlife Trust (see Figure 1, p32). It is a designated Local Wildlife Site (LWS).

The reserve is located on the River Dearne floodplain, and parts were historically managed as traditional 'Ings' (from the Old Norse for flooded grasslands) whereby the hay crop and aftermath cattle grazing by the local township was carefully controlled through the manipulation of water levels. However changes in agriculture and the advent of coal-mining and expansion of settlements brought about major changes (Hey & Rodwell, 2006) such that the reserve now comprises floristically poor pasture and marsh, a 'Flash' (a local term for a waterbody caused by mining subsidence, see Figure 9, p41) and a recently created hay-meadow (see Figure 2, p32). The surface topography of the pasture is ridge-and-furrow and map evidence shows the land has been managed grassland for over a hundred years.

After acquisition, the Trust embarked upon a programme of management targeted at improving the wetland wildlife including the expansion of the established special interest of breeding wetland waders and wildfowl, wintering wildfowl, and passage migrants especially waders.

This study reports on the changes to the breeding bird community of the site from 2003 to 2019 and discusses the links with the management measures made.

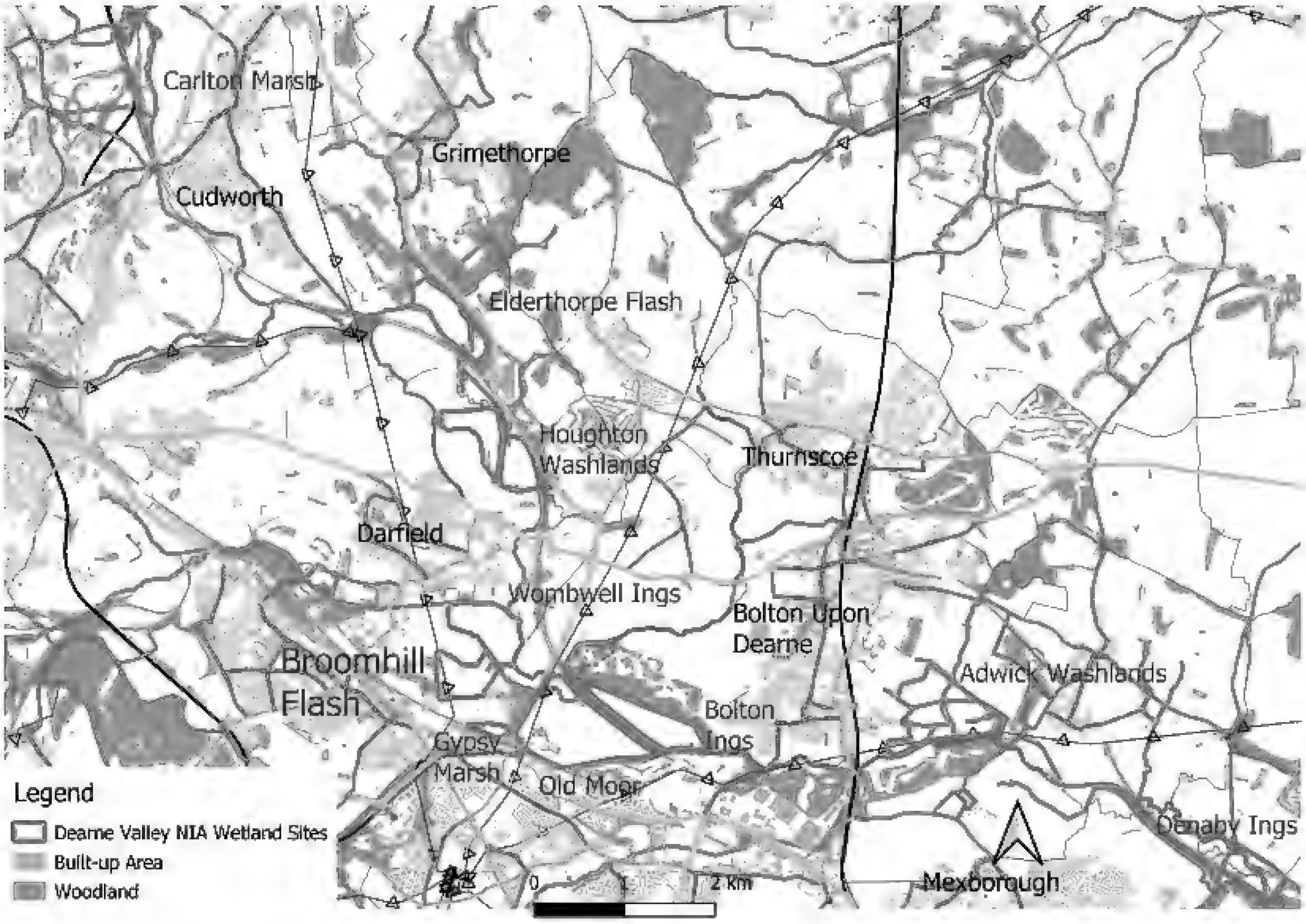

Figure 1. Wetland sites of the Dearne Valley Nature Improvement Area. Contains Ordnance Survey data Crown Copyright [and database right] 2020.

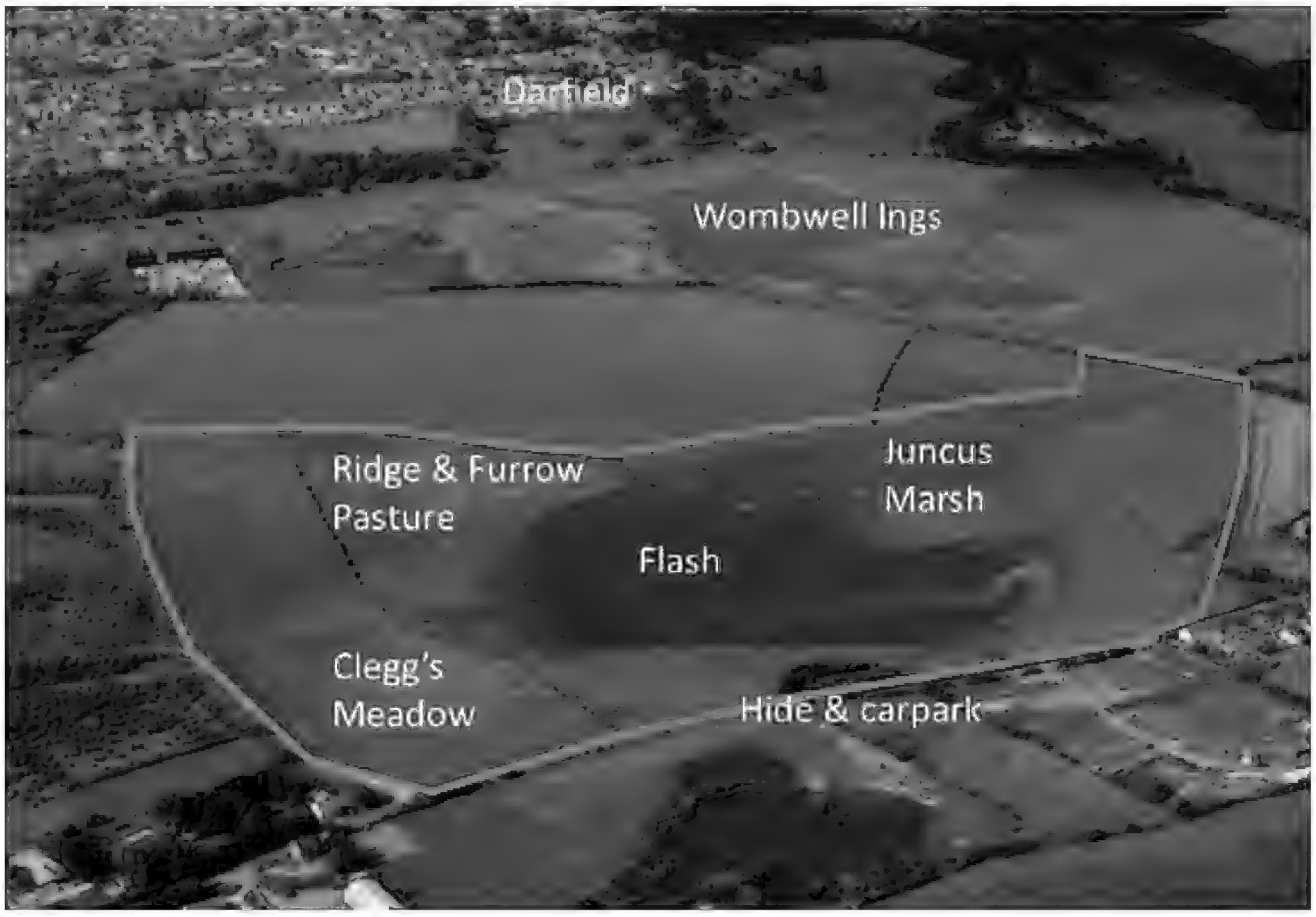

Figure 2. Broomhill Flash nature reserve, Wombwell, Yorkshire (red outline), looking north-east from Wombwell.

Management changes
When acquired, Broomhill Flash was used for rearing pedigree Ayrshire cattle, with up to 40 bullocks grazing between April and October, and some fertiliser and lime applications. The Flash levels were kept as low as possible via an outfall drain to the Bulling Dike, with frequent clearing. The adjacent 12-acre arable field was intensely cultivated for winter wheat and barley. The surrounding and internal gappy hedges were flailed heavily. In addition, the site was regularly shot during the shooting season. Despite this, it was recognised as an important place for birds and the tenure by farmer Mr L. Morrell, a tenant of the Fitzwilliam estate which owned large landholdings across south Yorkshire, was helpful in various local arrangements by the Barnsley Bird Study Group and the Yorkshire Wildlife Trust which secured the Flash for intermittent periods until the estate was sold in the late 1990s.

After acquisition, the Trust applied for a Countryside Stewardship grant and implemented the recommended prescriptions for management of wet lowland grassland and open waters. Grazing was continued to a grazing licensee, but with reduced stocking levels (15 bullocks per season April to October), with no fertiliser or pesticide applications, but the main investment was the installation of a large sluice, with two water-controlling penstocks set at different heights to try and replicate the recommended conditions for the breeding waders, Lapwing, Snipe and Redshank, which were already present in small numbers. These are of high water-levels in winter followed by a gradual Spring drawdown to provide a constant edge of marshy or muddy edges as chick-feeding areas (Crofts & Jefferson 1999). High winter water-levels would also support wintering wildfowl as marshy areas would be flooded and seeds would be available in the shallow water.

After the breeding season, the water levels were dropped even further in August to create muddy shallows for autumn passage waders such as Ruff *Calidris pugnax* , Greenshank *Tringa nebularia* and Spotted Redshank *Tringa erythropus*, before the sluice was closed in November to allow water levels to rise and replenish the Flash.

In 2006 an adjacent 11-acre arable field was bought separately and planted as a hay-meadow (Lunn, *in prep*.). Named after the late Yorkshire naturalist and broadcaster Michael Clegg, the meadow now supports a diverse range of meadow plant species and is managed as a hay-crop with no fertiliser or pesticide application, cropping in early July followed by aftermath grazing by cattle (let in from the adjacent Broomhill Flash pastures) until November. The hay meadow provides feeding areas for waterfowl as well as some nesting opportunities and supports resident Brown Hares *Lepus europaeus*.

Some habitat creation works have periodically taken place around the Flash, with ditches, pools and islands created through excavation, notably in 2007, 2010, 2015 and 2019.

Monitoring and analysis methods
A full record of the numbers of the species breeding and their hatching success is given in Appendices 1 and 2, accessible at https://www.ynu.org/naturalist.

Local birders visit the site every day of the year using the car-park and hide which overlooks the Flash and sightings are logged. The author made special effort to supplement these records with targeted visits to record displaying birds, nests and broods such that the composite record

gives a reasonably accurate picture of breeding activity.

Species diversity is relatively well recorded. Species displaying, mating, and caring for broods are readily observed, whereas for more cryptic species such as Snipe and Water Rail *Rallus aquaticus*, estimates have been derived using recognised techniques (Gilbert *et al*., 1998).

New broods are noted as they can be readily identified and so productivity is presented as hatching success (Table 1), but rearing success has been difficult to assess for waders as the chicks are obscured by the summer growth of marshy vegetation, and for wildfowl broods by the effects of predation and creching by species such as Gadwall *Mareca strepera* and Canada Goose *Branta canadensis*.

Table 1. Breeding productivity of waterfowl at Broomhill Flash 2002-2019.

Species	**Young hatched**	**Species**	**Young hatched**
Black-headed Gull	808	Shelduck	25
Tufted Duck	686	Little Ringed Plover	12
Gadwall	459	Greylag Goose	10
Mallard	435	Common Tern	6
Canada Goose	295	Lesser Black-backed Gull	3
Coot	237	Great Crested Grebe	3
Little Grebe	158	Water Rail	3
Shoveler	102	Teal	2
Lapwing	59	Oystercatcher	2
Moorhen	52	Ringed Plover	1
Ruddy Duck	35	Goosander	0
Redshank	34	Snipe	0
Pochard	30		
Mute Swan	26	**TOTAL**	**3483**

For analysis, species have initially been grouped into four – wildfowl (ducks, geese and swans); gulls and terns; grebes and rails; and waders, with commentary on individual species noted in the text.

Results

Species diversity

Twenty-six species of waterfowl bred or attempted to breed, with 1588 total breeding attempts.

The general trend (Figure 3) shows an increase from immediately after acquisition in 2002 when 8 species attempted to breed to a peak in 2019 when 18 species attempted to breed. After a gradual rise in the first six years to 14 species, the diversity has remained steady with usually 14 or 15 species breeding.

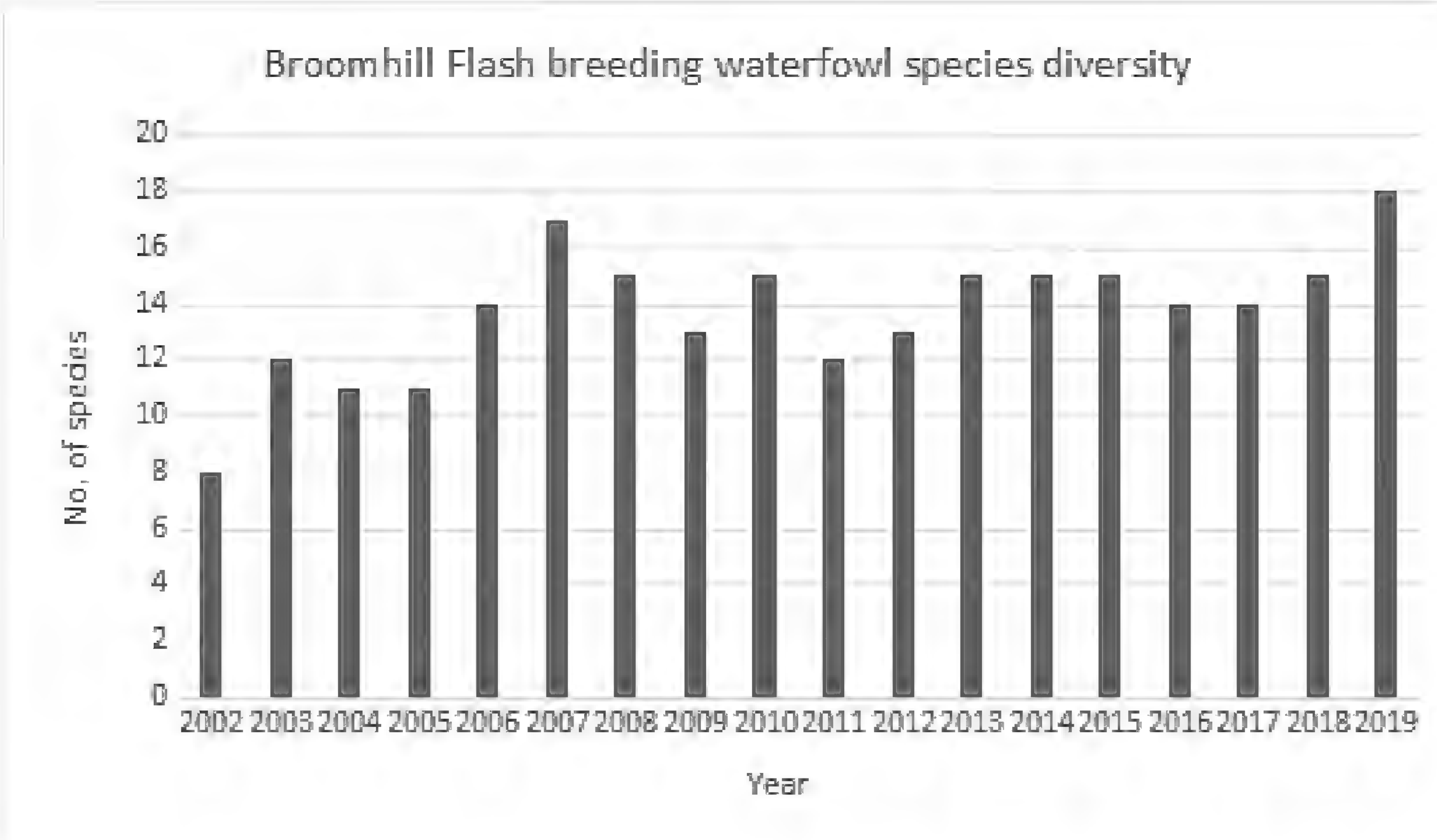

Figure 3. Broomhill Flash breeding waterfowl species diversity 2002-2019.

Only 5 species have been consistently present since the outset (Canada Goose, Coot *Fulica atra*, Moorhen *Gallinula chloropus*, Little Grebe and Lapwing), however Mallard *Anas platyrhynchos*, Tufted Duck *Aythya fuligula*, Snipe and Redshank have only been absent for single years. Common Terns *Sterna hirundo* vacated the site in 2006, probably due to Black-headed Gulls *Chroicocephalus ridibundus* colonising the site and ousting them from the nesting rafts. This latter species now accounts for the bulk of the breeding attempts in any one year. Ruddy Ducks *Oxyura jamaicensis* were established as regular breeders up to 2008 when the national eradication programme was in progress, although the Trust did not allow culling on the reserve and the species is now effectively extinct in the UK.

Of the later colonisers, Mute Swan, Gadwall, Water Rail and Oystercatcher *Haematopus ostralegus* have become more consistent, whereas other species have been intermittent in breeding, notably Shoveler, Pochard *Aythya ferina* and Shelduck *Tadorna tadorna*. Attempts by the small waders Ringed *Charadrius hiaticula* and Little Ringed Plovers *C. dubius* have been predictably opportunistic, depending on suitable open ground conditions; indeed the 2019 records reflect their use of an adjacent wetland construction site in progress. Some species have only attempted on one or two occasions, notably Goosander *Mergus merganser* (when a clutch of abandoned eggs was found in a Barn Owl *Tyto alba* nestbox), Lesser Black-backed Gull *Larus fuscus*, Teal *Anas crecca*, Great Crested Grebe *Podiceps cristatus* and Greylag Goose *Anser anser*.

Abundance

Overall, some 398 breeding attempts were made by swans, geese and ducks; 340 by waders; 295 by grebes and rails; and 555 by gulls and terns.

Figure 4 (p36) shows the overall trend of breeding attempts in the four broad groups. The

steady increase of the Black-headed Gull colony (which accounts for the majority of the gulls and terns) can clearly be seen, whereas the overall wildfowl numbers, as well as grebes and rails, have remained consistent after the initial colonisation. Waders were more numerous between 2006 and 2009, possibly reflecting the changes in the management and use of the nearby Wombwell Ings and other sites (see below).

After the initial rapid rise in both species and breeding attempts, numbers rose to a high in 2010 when conditions were clearly optimal for some groups, and since then there appears to be more of a cyclical pattern affected by the increasing Black-headed Gull colony, although this is likely to be circumstantial due to many factors at play (see discussion).

Wildfowl

Figure 5 (p37) shows the number of breeding attempts by the principal species of wildfowl at Broomhill Flash over the study period. After the initial change of management, more species colonised and more breeding attempts were made up to a maximum of 48 in 2010. Numbers have fluctuated a little with around 24 breeding attempts per annum (median 23.5, range 1-48, n=19), with the bulk of the numbers taken by Tufted Duck, Gadwall and Mallard.

Tufted Duck reached a maximum of 16 broods in 2010, Gadwall 12 broods in 2018 and Mallard 9 broods in 2008. Other ducks have been less consistent. Ruddy Ducks were gradually increasing up to the eradication programme but are now extinct. Shoveler with 15 broods (5 in 2010) has fluctuated, although rearing success has been excellent. Pochard bred 2013-2016 with a maximum of 3 broods in 2016 but have now seemingly abandoned the site. Shelduck (3 attempts) and Teal (1) have also bred successfully, whilst Goosander has also attempted once but the clutch of eggs (in a Barn Owl box) was abandoned.

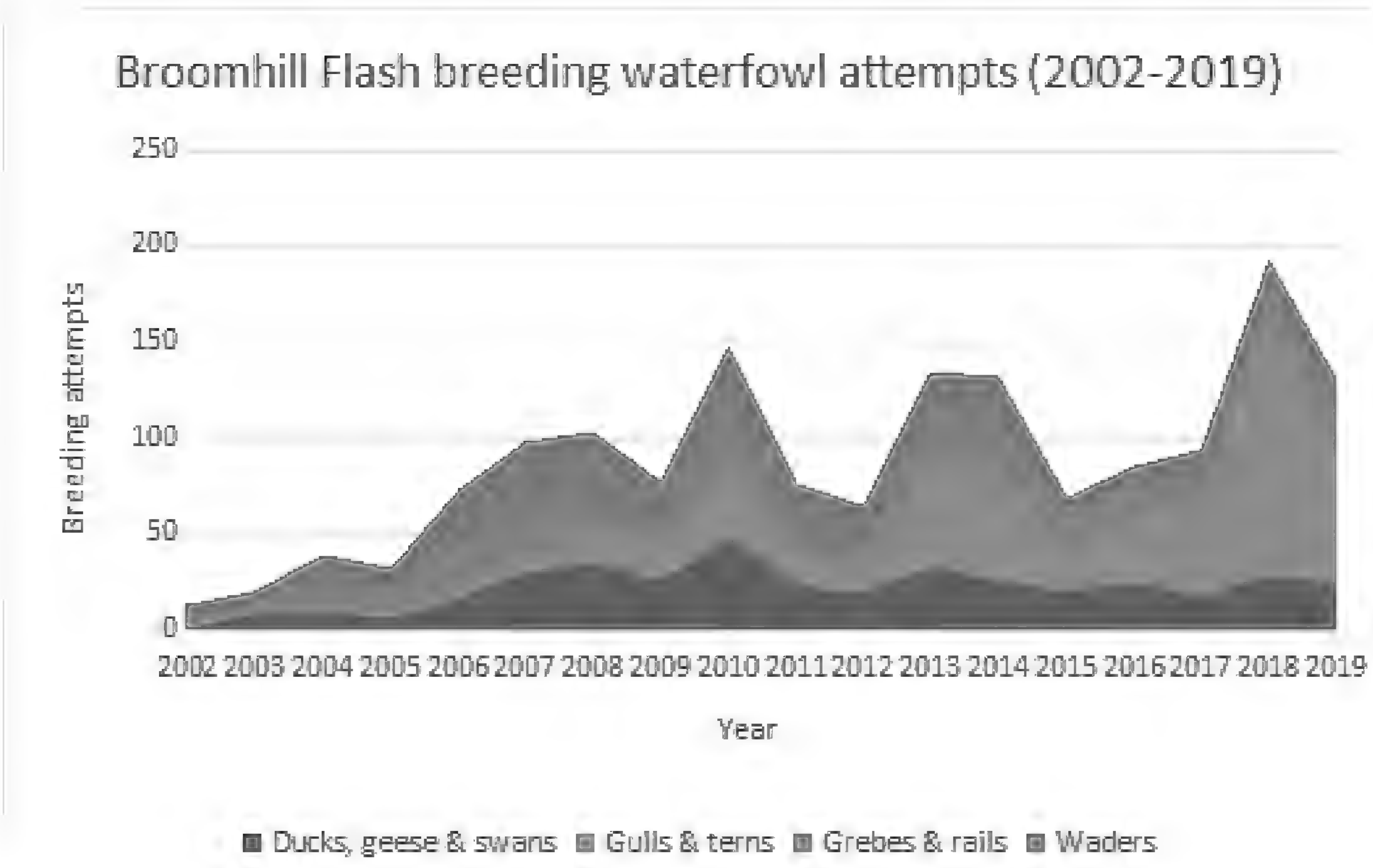

Figure 4. Number of breeding attempts by waterfowl at Broomhill Flash 2002-2019

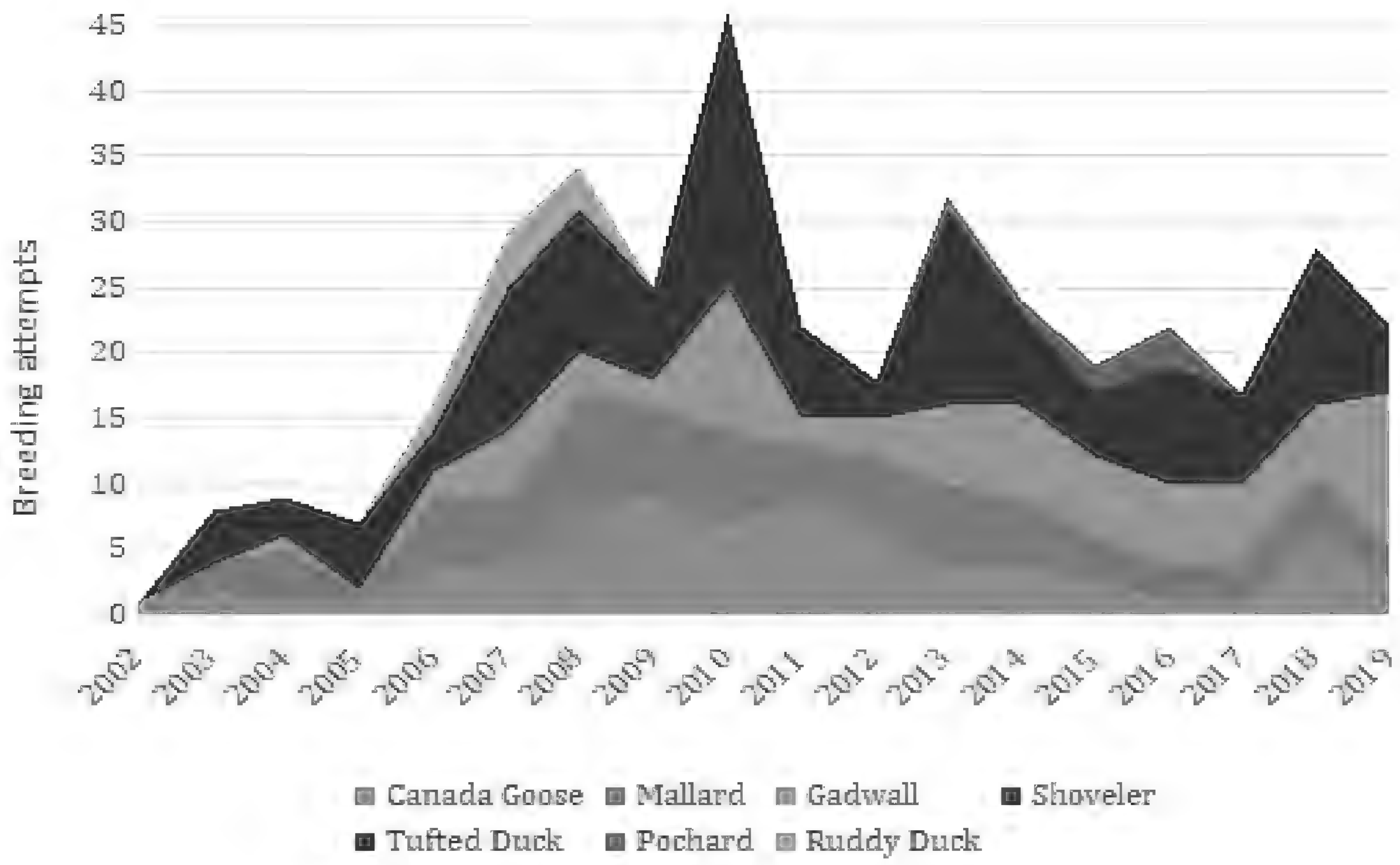

Figure 5. Number of breeding attempts by the seven principal species of wildfowl at Broomhill Flash 2002-2019. For the other five species see text.

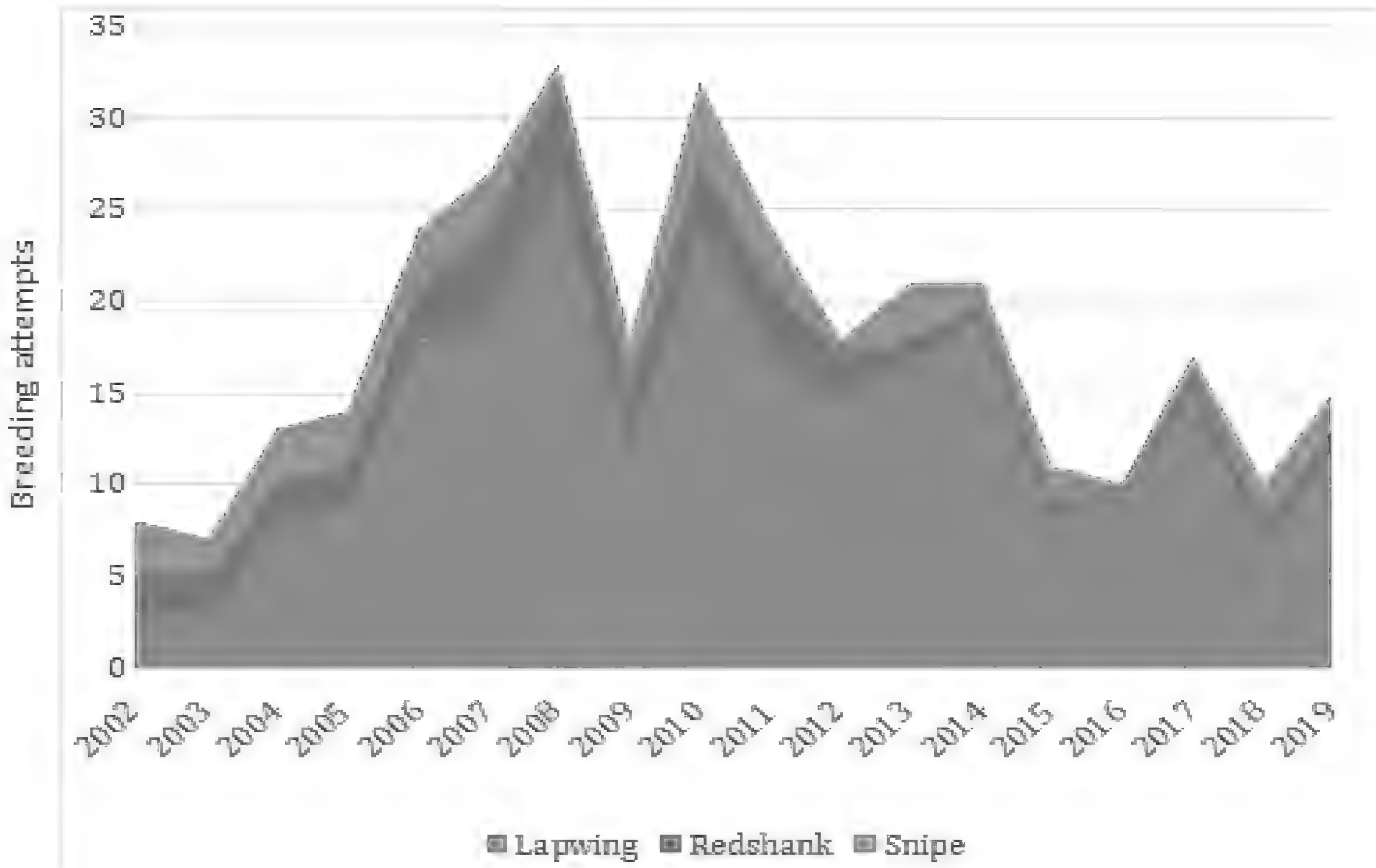

Figure 6. Breeding attempts by the three principal species of wader at Broomhill Flash 2002-2019. For the other three species see text.

Waders

Conservation of the breeding wader community of wet lowland grasslands (Lapwing, Redshank and Snipe) has been a priority of the Trust's management of the reserve, and has been a success with all three species still breeding at the site in the face of continuing national declines in the lowlands. However, fortunes have been mixed (Figure 6, p37).

For Lapwing, the most numerous breeding wader, Broomhill Flash always benefitted from the numbers on the adjacent Wombwell Ings to the north, and also from the occasional Spring crop sown (which provides ideal nesting conditions) in the field which separates the two reserves. A total of 243 breeding attempts have been made over the study period, with a maximum of 27 pairs recorded in 2008 with many observed sitting on nests in the arable field in Spring, and then taking the young down to feed on the Flash thereafter. Unfortunately the last decade has seen a huge increase in the unofficial use of Wombwell Ings for recreational walking, mostly with dogs, from nearby settlements, with uncontrolled animals roaming freely over the Ings grasslands, and this has been instrumental in the decline of breeding waders there (D. Waddington, *pers. comm.*). This has had a knock-on effect on Lapwings breeding on the Flash, although conditions are good enough (and with no disturbance) to maintain around 10 pairs. Another intriguing possibility may be a re-location of some breeding pairs to the newly created wetland at Adwick Washlands some 3 km to the east which now constitutes the best breeding site in the region with an estimated 50 pairs out of a Dearne valley total of around 100 pairs (Capper, 2019).

Redshank have fared less well. With a total of 40 breeding attempts, the best years were between 2007 and 2011 with maxima of 5 pairs in 2009 and 2010 and were a consequence of the excavations and new wetland areas created in 2006. Since then numbers have declined to a single pair despite high Spring water levels and (to the human eye) ideal conditions. Again, numbers may have been affected by the decline in breeding Redshank on the nearby Wombwell Ings due to disturbance; however the wetland reserve at Adwick Washlands now supports up to 25 breeding pairs, possibly drawing birds from other sites in the Dearne valley such as Broomhill Flash.

Snipe were present in higher numbers early in the tenure of the Flash by the Trust, with a maximum of 4 drummers in 2010, reducing to one or two in later years and not recorded in 2016. However, the species can be difficult to detect when present in small numbers and drumming infrequent (D. Waddington *pers. comm.*).

Of the remaining waders, Oystercatchers have had 5 attempts since first present in 2004, and although present every Spring, are thought to mainly attempt to breed off-site. On the few occasions where nests have been confirmed, they have been in the open ground conditions they favour such as on the arable field in Spring crops, and during the recent adjacent excavations. Oystercatchers are only a relatively recent colonist in the Dearne valley, having colonised around 1996 and successful breeding in the wider area was first confirmed in 1999 at Broomhill Flash (Pearce & Middleton 2018).

Both Ringed and Little Ringed Plovers have bred (3 and 9 attempts respectively) but are opportunistic, taking advantage of suitable conditions (stony open ground) when available. The attempts in 2019 when 3 pairs of LRPs fledged 9 but the single pair of Ringed Plovers were

predated, were located on flood protection/wetland habitat creation excavations to the north of the Flash (Lunn *in prep*.).

Gulls and terns

Three species have bred (Black-headed Gull, Lesser Black-backed Gull, and Common Tern) – see Figure 7 for Black-headed Gull and Figure 8 (p40) for Common Tern.

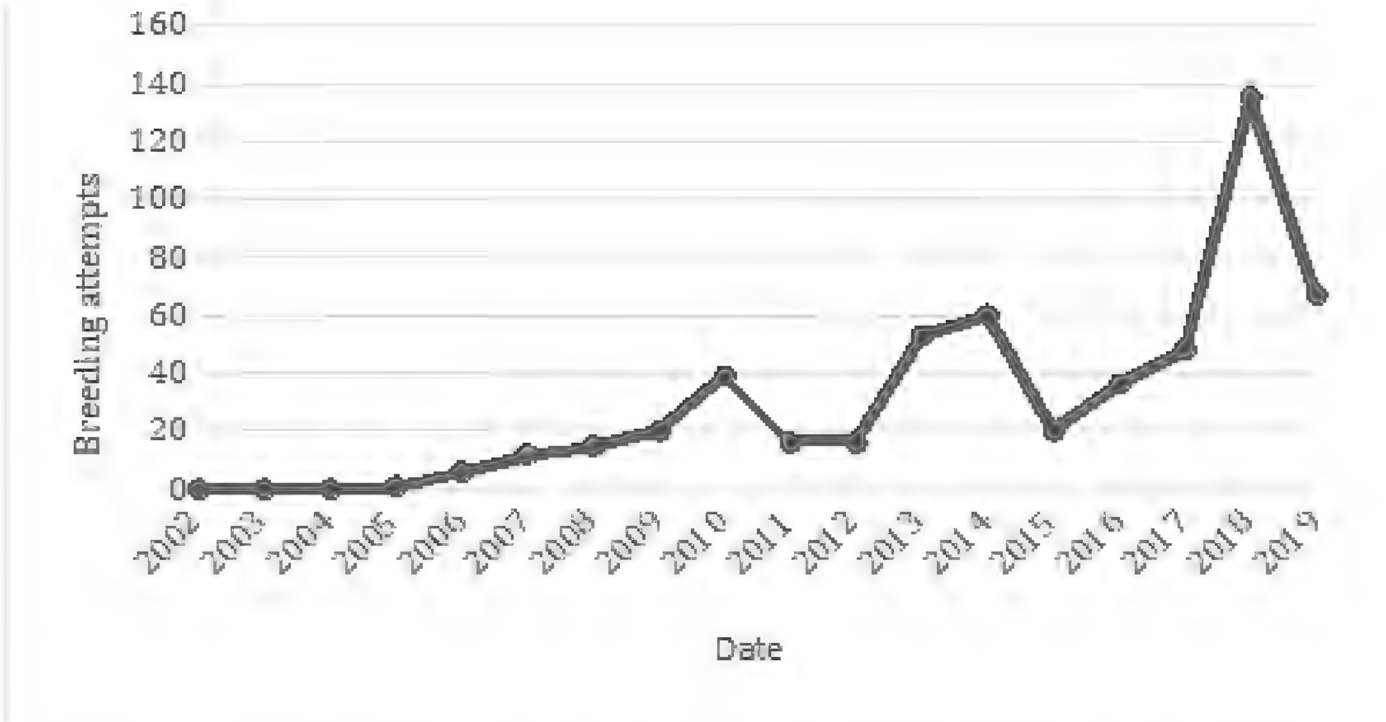

Figure 7. Breeding attempts by Black-headed Gulls, Broomhill Flash 2002-2019.

Breeding Common Terns were a popular attraction at the Flash when the Trust bought the site. Local volunteers had installed three giant colliery winding drums sideways in the Flash to act as nesting islands, with wire mesh surrounds to stop young birds falling into the water. They were successful with up to three pairs nesting and raising young up to 2006.

Further fibre glass islands were installed in 2005 with the intention of increasing the tern colony; however Black-headed Gulls colonised instead. The terns abandoned the site after 2006 probably as a result of competition with the gulls which had already established their territories on the islands before the terns arrived back in mid-May.

The Black-headed Gull colony has gradually increased, and they are now the most abundant breeding species at the Flash with up to 135 pairs. Numbers are limited by available nest sites. Four islands with up to 10 pairs each are the regular sites, with other pairs nesting in marginal Soft-rush *Juncus effusus* beds or, as in 2019, on a constructed clay island. The Broomhill Flash colony itself is an offshoot of the much larger colony at Old Moor where up to 2,300 pairs nest (D. Waddington, pers. comm.).

A pair of the third species, Lesser Black-backed Gull, bred successfully in 2019 raising three young. They ousted Black-headed Gulls (usually 10 pairs) from one of the rafts. Birds had been visiting the Flash from the nearby Old Moor reserve for a number of years during the breeding season to predate young Black-headed Gulls which form their main prey item at that site (Capper, 2019; Lunn, 2020).

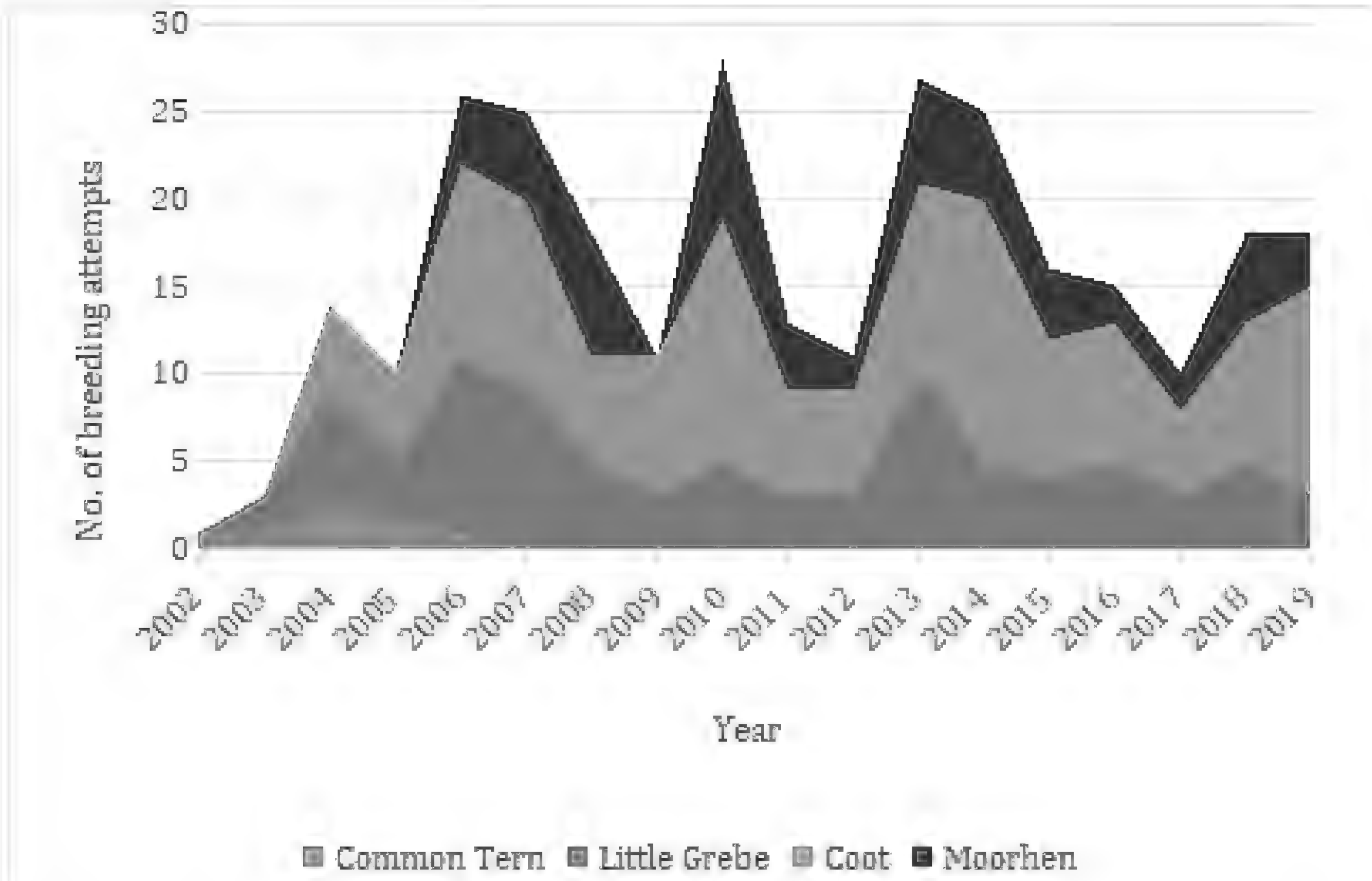

Figure 8. Breeding attempts by 4 principal species of other waterfowl (gulls, terns, grebes, rails) with the exception of Black-headed Gull (see Fig. 5, p37), Broomhill Flash 2002-2019. For the other three species see text.

Grebes and rails

Two species of grebe, Little and Great Crested, have nested at the Flash, with three species of rail (Moorhen, Coot and Water Rail).

Great Crested Grebes nested once in 2016 raising three young but are not regular users of the site. Little Grebes on the other hand have been present from the outset with up to 10 pairs breeding, often with second broods such that it is difficult to monitor productivity.

Up to 14 pairs of Coot have bred but with nest sites limited to clumps of Soft-rush around the margins of the lake, nests are quite exposed, and they suffer high predation. Moorhen are difficult to assess as they spend much time in the marshes and ditches although up to 9 pairs have been estimated. Water Rails bred for the first time in 2016 when a marsh on the north side of the lake had become well-established, and they have been present every year since with well-grown young recorded.

Production

Table 1 (p34) shows the hatching success of breeding waterfowl at the Flash during the study period. 3,483 young were recorded over the 19 seasons, around 183 per annum. Although the figures are impressive, some caution must be applied to various species and the totals will be an underestimate.

Broods of ducks, geese, swans are the most straightforward to count whereas the waders are much more difficult. For example, Lapwings made a total of 261 breeding attempts but only 59 young were recorded, while Snipe, which have been present almost every year and are likely to

have raised some young, have had none recorded.

Estimating fledging success has not been attempted given the scale of the task, and no analysis of the effects of predation has been made, although this will have had some impact with regular observations of young taken by Fox *Vulpes vulpes*, Marsh Harrier *Circus aeruginosus* and Lesser Black-backed Gull being recorded.

Figure 9. Broomhill flash looking north.

Discussion

The results demonstrate the success of the acquisition and appropriate management of land for the conservation of the breeding birds of lowland wet grassland and open waters. Twenty-six species of waterfowl have bred, hatching a minimum of just under three and a half thousand young in the study period. The retention of the core characteristic species of this habitat (Lapwing, Snipe, Redshank, and Shoveler) over the period also indicate that the careful management of the water levels and land can be helpful for these species, especially against a background of continuing national decline.

After the instigation of management measures there was an expected rapid rise in the diversity of species and the number of breeding attempts by waterfowl, with a median of 14 species (range 8-18, n=18) per annum. The fortunes of some species, however, have been variable and reflect many different influences and pressures, both at site level and population level. Within-site factors, ostensibly under the control of land managers (but in practice hard to achieve consistently) have had an influence on the breeding bird community.

Farming - the cattle grazing regime and cropping of adjacent arable land – forms the major land-use activity. Here, the prescribed grazing levels (0.6 beasts/acre during April-October) produced tussocky grassland favoured by breeding waders, but have not been high enough to suppress the invasion of Softrush which has converted some open grassland areas to species-poor marsh, and which has needed the introduction of mechanical mowing to keep in check (weed-killers not being allowed by the Trust). However, the cropping of adjacent arable land has sometimes been positive in those years where a spring crop has been sown, boosting Lapwing numbers (although in general the intensive management has been detrimental to other farmland wildlife).

Building more heterogeneity into the habitats - more islands, ditches, and scrapes - has required new excavations, but new islands have supported nests of Black-headed Gulls and some of the early ditching and scrape work favoured Redshanks. The provision of artificial features such as floating rafts have seen breeding Black-headed Gulls, Lesser Black-Backed Gulls and Common Terns; however measures to encourage the latter will need adjustment if they are to return, for example by taking the rafts into dock over the winter before re-positioning them in mid-May. Even so, colonisation by surplus Black-headed Gull pairs could be the result.

Predation, for example by Lesser Black-Backed Gulls on Black-headed Gull chicks and waterfowl broods, but also by Foxes and Carrion Crows *Corvus corone* is part of the story of many nature reserves, and land managers in their setting of conservation aims have to weigh the allowance of natural processes to take their course against the desire to favour species or species groups such as waders. Given the continuing decline in the fortunes of many ground-nesting waders nationally and globally, the discouragement or elimination of predators can be a controversial topic, although solutions such as the installation of electric fences have proved to be very successful elsewhere, not least at the nearby Adwick Washlands reserve (Capper, *op.cit.*).

The most significant external factor for the reserve's fortunes is the weather, especially the rainfall required to re-charge the Flash over the winter period, and how to manipulate this at crucial times of the season. Some years e.g. 2010 retained very high water levels in early Spring and combined with the relatively newly created ditches, scrapes and islands, produced a bumper season, whereas in other years levels were not quite as optimal. Deliberate vandalism of the sluice resulting in lower water levels, and complaints from neighbours about effects on crops were some of the day-to-day challenges of being able to optimise control over the levels. Weighing the gradual reduction of water levels in Spring, particularly if the Flash is not fully re-charged, with allowing waterfowl broods to mature and the demands of neighbours can be more of an art than a science.

Effects at population level for the various species have clearly had an influence. For species increasing in number nationally such as Greylag Goose and Gadwall or newly colonising like Oystercatcher, the reserve offers new opportunities for establishing local populations; however for those species in national or international decline, particularly waders, but also Pochard, the management of the reserve has provided an important local site for the maintenance of local populations.

Future management decisions for the reserve will be influenced by conservation priorities at different spatial scales. Being part of the wider Dearne Nature Improvement Area – which embraces the collection of wetlands in the Dearne catchment – is a helpful context where the efforts at Broomhill Flash can contribute to, and complement the efforts of other organisations, particularly where species need to maintain a metapopulation in order to survive. Priority will continue to be given to trying to maintain, or even enhance the populations of Snipe, Lapwing, Redshank, Shoveler and Pochard whilst supporting others such as Mallard, Black-headed Gull and Water Rail which are still breeding species of national concern. The use of a variety of wetlands, including some quite small features, across the wider landscape by some birds can be an important feature in the conservation of populations of waterfowl (Ausden *et al*., 2014), for instance Broomhill Flash is already used by dispersing young Bitterns *Botaurus stellaris* from the nearby breeding site at Old Moor.

The presence and management of other reserves managed for breeding waterfowl, especially waders of wet lowland grasslands, in the Dearne catchment means that the fortunes of breeding waterfowl at Broomhill Flash are more secure today than they have ever been.

Readers of course will note the irony that Garganey *Anas querquedula* has not yet bred or been seen to attempt to breed, despite it being the Trust's 'talisman', although it occurs regularly on passage and is still a tantalising prospect for the future.

Summary

The fortunes of 26 species of breeding waterfowl at Broomhill Flash, southern Yorkshire between 2002 and 2019 are documented. A minimum of 1588 breeding attempts were made, and 3483 young were hatched.

Factors affecting success are discussed, but the study confirms the success of securing and managing sites for their breeding bird communities of wet lowland grassland and open waters.

References

Ausden, M., Hirons, G., Lock, L. & White, G. (2014) Managing and re-creating wetlands in Britain for potential colonists. *Brit. Birds* 107, 726-755.

Capper, M. (2019) Great bird reserves. RSPB Old Moor and the Dearne Valley. *Brit. Birds* 112, 70-88.

Clegg, T.M. (1962) Notes on the natural history of some South Yorkshire flashes, 1954-61. *The Naturalist* 87, 25-129.

Crofts, A. & Jefferson, R.G. (eds.) (1999) *The Lowland Grassland Management Handbook 2nd edition.* English Nature/The Wildlife Trusts, Peterborough.

Eaton M.A., Aebischer N.J., Brown A.F., Hearn R.D., Lock L, Musgrove A.J., Noble D.G., Stroud D.A. and Gregory R.D. (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108, 708–746.

Gilbert, G., Gibbons, D. W., & Evans, J. (1998) *Bird Monitoring Methods: a manual of techniques for key UK species.* RSPB/BTO/JNCC/WWT/ITE/The Seabird Group, Sandy.

Hey, D. & Rodwell, J. (2006) Wombwell. The landscape history of a South Yorkshire coalfield township. *Landscapes* 7(2), 24-47.

Lunn, J. (2020). Lesser Black-backed Gulls breeding in the Dearne Valley, southern Yorkshire. *Sorby Record* 55, 78-80.

Lunn, J., Middleton, P. & Bull, K. (2011) The restoration of Thorne and Hatfield Moors. *Brit. Wildlife* 22(5), 322-332.

Milsom, T. (ed.) (2006) *Land Use, Ecology and Conservation in the Lower Derwent Valley.* PLACE, York.

Pearce, D.M. & Middleton, P. (2018) *Atlas of Breeding Birds in the Barnsley Area 2006-2011*. Barnsley, Barnsley Bird Study Group.

Ramsar Convention on Wetlands. (2018) *Global Wetland Outlook: State of the World's Wetlands and their Services to People*. Gland, Switzerland: Ramsar Convention Secretariat.

Rothero, E., Lake, S. and Gowing, D. (eds.) (2016) *Floodplain Meadows – Beauty and Utility. A Technical Handbook*. Milton Keynes, Floodplain Meadows Partnership.

Sills, N. (2017) The cranes of Lakenheath Fen. *Brit. Wildlife* 28, 309-316.

Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D., & Noble, D. (2020) Population estimates of birds in Great Britain and the United Kingdom. *Brit. Birds* 113, 69-104.

Pondweeds (Potamogetonaceae) in canals of Yorkshire and neighbouring counties

R. Goulder 5 Bishops Croft, Beverley HU17 8JY
Email: r.goulder@kategoulder.karoo.co.uk

Introduction

This article is about observations I have made on pondweeds in the canals of Yorkshire and neighbouring counties (Figure 1). Pondweeds grow in fresh waters and are monocotyledons with submerged stems and leaves that can be broad or linear; some have floating leaves. Most pondweeds (in the family Potamogetonaceae) belong to the genus *Potamogeton*, although Opposite-leaved Pondweed *Groenlandia densa*, Fennel Pondweed *Stuckenia pectinata* and Horned Pondweed *Zannichellia palustris* were also encountered. Nomenclature follows Stace (2019); in earlier editions Horned Pondweed was in the family Zannichelliaceae and Fennel Pondweed was known as *Potamogeton pectinatus*. Scientific names are given at first mention in the text and in the tables and figure legends.

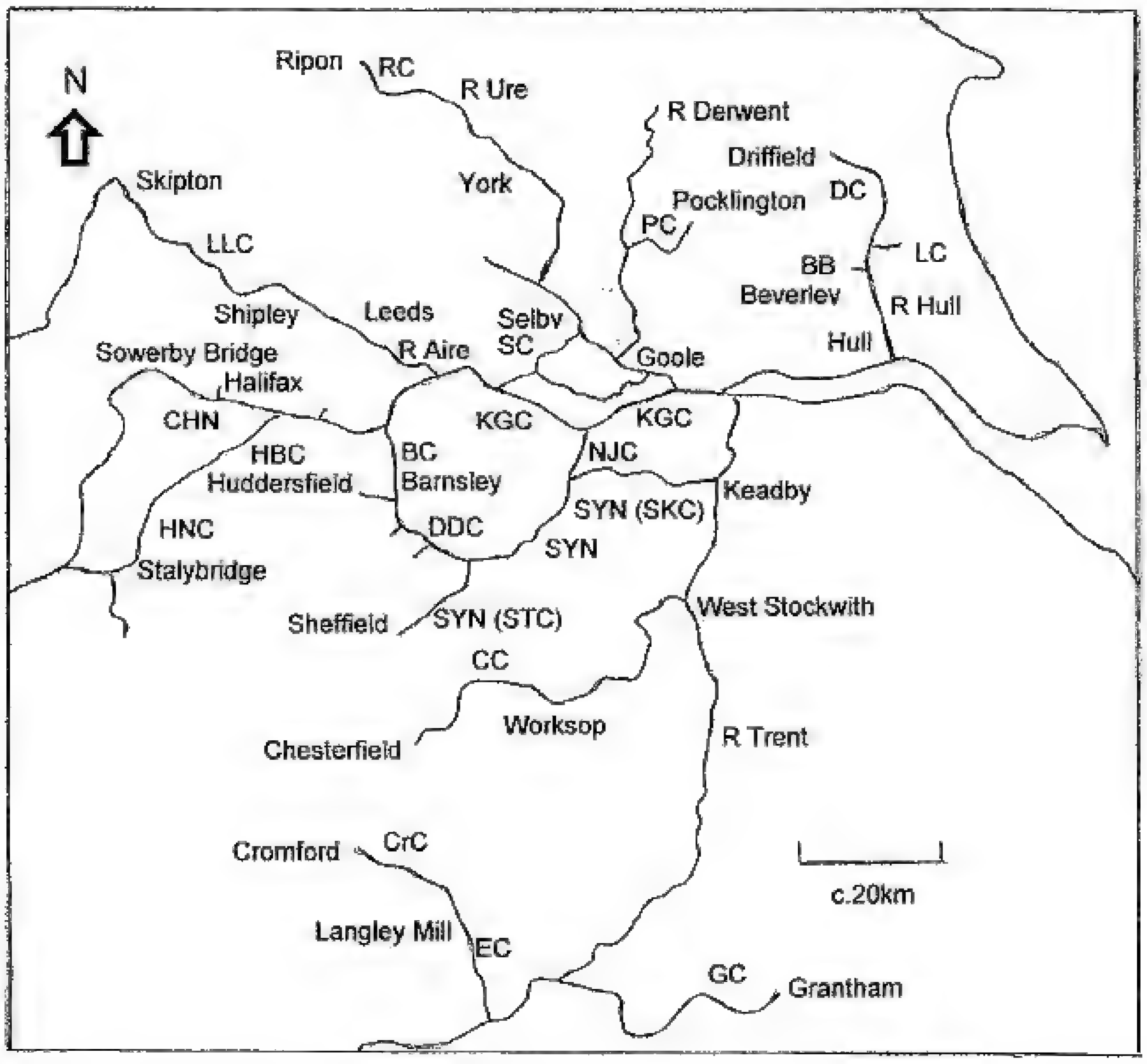

Figure 1. Sketch map to show the line of the canals visited; occasionally the line is no longer obvious on the ground. Rivers are included only when needed to clarify navigation routes. BC=Barnsley Canal, BB=Beverley Beck, CHN=Calder & Hebble Navigation, CC=Chesterfield Canal, CrC=Cromford Canal, DDC=Dearne & Dove Canal, DC=Driffield Canal, EC=Erewash Canal, GC=Grantham Canal, HBC=Huddersfield Broad Canal, HNC=Huddersfield Narrow Canal, KGC=Knottingley & Goole Canal (Aire & Calder Navigation), LLC=Leeds & Liverpool

Canal, LC=Leven Canal, NJC=New Junction Canal, PC=Pocklington Canal, RC=Ripon Canal, SC=Selby Canal, SYN=South Yorkshire Navigations (STC=Sheffield & Tinsley Canal, SKC=Stainforth & Keadby Canal). The Lancaster Canal is beyond the map to the west.

Preston (1995) drew attention to the importance of canals for these plants. He pointed out that canals have harboured abundant pondweeds since the 19th century and are sometimes refuges for rare examples. Briggs (1996, 2006, 2012) has written about aquatic plants in UK canals and has stressed the abundance, diversity and conservation value of pondweeds. In Yorkshire's canals, pondweeds are sometimes abundant and conspicuous; for example, Perfoliate Pondweed *Potamogeton perfoliatus* in the Leeds & Liverpool Canal (Figure 2, p47) and Shining Pondweed *P. lucens* in the Pocklington Canal (Figure 3, p47). Rare species are found, such as American Pondweed *P. epihydrus* in the Calder & Hebble Navigation; or pondweeds may be sparse or not to be found (Goulder, 2019a).

Yorkshire and neighbouring counties have a great diversity of canals. Many are essentially 18th or 19th century waterways that have been continuously navigated – although now by leisure rather than commercial boats – such as the Leeds & Liverpool Canal, the Huddersfield Broad Canal, the Stainforth & Keadby Canal (South Yorkshire Navigations east of Bramwith) and canal sections of the Calder & Hebble Navigation and the South Yorkshire Navigations west of Rotherham. Others are large-scale waterways that carried large tonnages of freight, mostly coal, throughout the 20th century but which now, essentially, carry only leisure traffic. These include canal sections of the South Yorkshire Navigations between Rotherham and Bramwith, the Knottingley & Goole Canal (part of the Aire & Calder Navigation) and the New Junction Canal. Some canals have fallen into dereliction and survive as non-navigable channels, sometimes fading from or lost to the landscape – these include the Dearne & Dove Canal, Barnsley Canal, Leven Canal and parts of the Pocklington Canal. Others have been restored from dereliction and are now used by leisure boats – for example, the Huddersfield Narrow Canal, the Ripon Canal and parts of the Chesterfield and Pocklington Canals. All these canal types were included in the observations on pondweeds that are reported herein. The observations were made along canals in Yorkshire and neighbouring counties and, stretching a point, the Grantham Canal in Leicestershire. For information about the history and development of these canals see Hadfield (1970, 1972, 1973) and for current descriptions of navigable waterways Anon. (2006, 2009).

Recording pondweeds in canals

Pondweeds were recorded in discrete lengths of canal during May-September between 2010 and 2019. Along some canals the lengths were fixed at 0.5km, and 122 lengths (61km) were recorded in this way. Along other canals the lengths were variable, being delineated by features such as locks or bridges, and ranged from 0.03km to 3.5km (mean c.1.0km); 174 lengths along c.175km of canal were recorded in this way. Altogether, 296 lengths along c.236km of canal were surveyed. The canals visited are shown in Table 1. Distances surveyed and number of lengths are included. References that give information about exact locations and recording dates are listed in Appendix 1, accessible at https://www.org.uk/naturalist. Some lengths were visited in more than one year and the records given herein are for the most recent year unless otherwise indicated.

Pondweeds were retrieved from canals using a grapnel or an extensible walking pole with a hook attached to its end; it is always possible that some were missed – especially when the

water was turbid. They were identified using Preston (*loc. cit.*). Determination of linear-leaved plants was done using a dissecting microscope at x20 or x40 magnification, with emphasis on leaf dimensions, venation, nodal glands and stipules, and included sectioning of stipules (Preston tells how to do this). Small Pondweed *Potamogeton berchtoldii* and Lesser Pondweed *P. pusillus* have been shown to be clearly genetically different using isoenzyme variation (Kaplan & Štěpánek, 2003) but their separation using anatomy can be a problem. Determinations of these always included sectioning of young stipules (these are closed tubes in *P. pusillus* but open in *P. berchtoldii*). My initial determinations of Small Pondweed (from the Pocklington Canal in 2002; Goulder, 2003) and Lesser Pondweed (from North Cave Wetlands in 2001; Goulder, 2002) were confirmed by C.D. Preston.

The abundance of each pondweed was assessed in each length. This was done using the approach suggested for rivers by Holmes (1983), where abundance was recorded in three categories: 1=<0.1% whole-channel cover, 2=0.1-5% cover, or 3=>5% cover. Alternatively, abundance was described semi-quantitatively as occasional or rare (o/r), frequent (f) or dominant or abundant (d/a). Comparisons, when both scoring methods were used, along nineteen 0.5km lengths of the Chesterfield and Grantham canals, suggested that categories 1, 2 and 3 on Holmes' scale largely corresponded to my semi-quantitative scores of o/r, f and d/a (Goulder, 2019a).

The occurrence and distribution of pondweeds in canals

Fourteen Pondweeds were found in the canals of Yorkshire and neighbouring counties. Preston (*loc. cit.*) gives 21 'Linnaean species' (i.e. not hybrids) of *Potamogeton* as occurring in Great Britain (this includes *P. pectinatus*); 12 of them were found in my study. Pondweeds found are listed in decreasing order of frequency of occurrence in Table 2, p49. Fennel Pondweed was much the most often recorded, being found in 102 (34.5%) of the 296 lengths surveyed. Next, Curled Pondweed *Potamogeton crispus*, Broad-leaved Pondweed *P. natans* and Lesser Pondweed were found in between 20% and 10% of lengths. Perfoliate Pondweed, Horned Pondweed, Blunt-leaved Pondweed *P. obtusifolius*, Hairlike Pondweed *P. trichoides*, Shining Pondweed, Small Pondweed and Flat-stalked Pondweed *P. friesii* were recorded in between 10% and 2% of lengths. Grass-wrack Pondweed *P. compressus*, American Pondweed, and Opposite-leaved Pondweed were found in <1% of lengths.

Table 1 (p47) shows the pondweeds that were found in each canal (it is an invitation to readers to visit canals and find more). Some pondweeds were essentially ubiquitous, being found in most canals. Curled Pondweed and Fennel Pondweed were recorded in 17 out of 23 canals in the latest surveys, and in two others in earlier surveys. Broad-leaved Pondweed was found in 16 canals. Other pondweeds were found in fewer canals. Opposite-leaved, Grass-wrack and American Pondweeds were each recorded in only one canal.

A record of presence or absence tells little about abundance. The abundance of some pondweeds (e.g. Fennel and Broad-leaved Pondweeds) ranged from dominant/abundant (>c.5% cover) to occasional/rare (<c.0.1% cover). Others, such as Small, Grass-wrack and Opposite-leaved Pondweeds were never more than occasional or rare. Table 3 p54, lists, in order of decreasing importance, the six pondweeds that in the most recent surveys achieved dominant/abundant status (>c.5% cover) in at least one canal length. Fennel Pondweed was dominant/abundant in 6.1% (18 out of 296) lengths. Broad-leaved, Perfoliate, Shining, and Blunt-leaved pondweeds were dominant/abundant in between 5% and 1% of lengths. Curled Pondweed was dominant/

abundant in one length (0.3%).

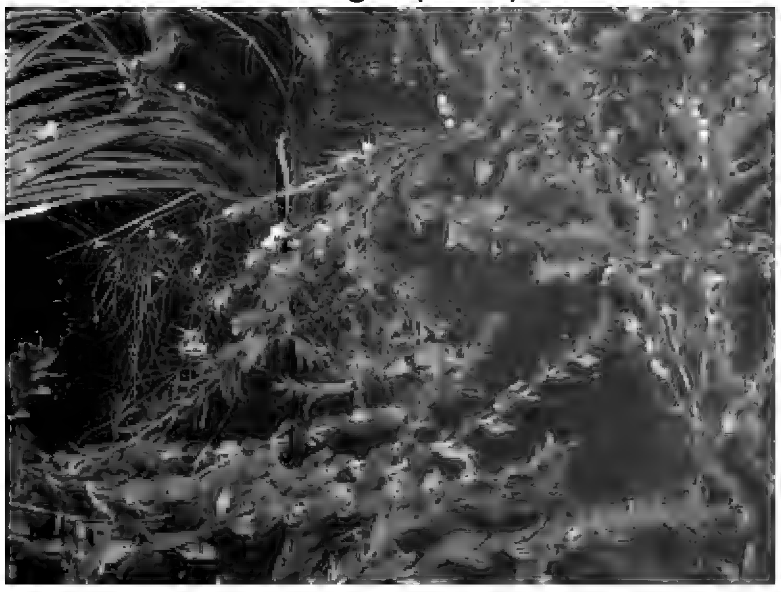

Figure 2. Submerged trailing shoots of Perfoliate Pondweed *Potamogeton perfoliatus* with the fine, linear leaves of Fennel Pondweed *Stuckenia pectinata* (centre left); Leeds & Liverpool Canal, central Leeds, June 2016. The robust linear leaves at the top left belong to Flowering-rush *Butomus umbellatus*.

Figure 3. Leafy shoots of Shining Pondweed *Potamogeton lucens* at the surface of the navigable channel of Pocklington Canal, with Nuttall's Waterweed *Elodea nuttallii*, Hagg Bridge, July 2013.

Table 1. Pondweeds found in the canals of Yorkshire and neighbouring counties 2010-2019

	Pondweeds found													
Canal (with number of lengths) and approximate total distance surveyed	*Groenlandia densa*	*Potamogeton berchtoldii*	*P. compressus*	*P. crispus*	*P. epihydrus*	*P. friesii*	*P. lucens*	*P. natans*	*P. obtusifolius*	*P. perfoliatus*	*P. pusillus*	*P. trichoides*	*Stuckenia pectinata*	*Zannichellia palustris*
Barnsley Canal (14 lengths) 9.1km	0	0	0	2	0	0	0	2 (2)	0	(+)	(+)	0	4 (1)	0
Beverley Beck (2) 1.2km	0	0	0	(+)	0	1	0	2	0	0	0	0	1	0
Calder & Hebble Navigation (25) 27.2km	0	(+)	0	1	2	0	0	2	0	0	4	3	0	0
Chesterfield Canal, Derbyshire (14) 15.9km	0	0	0	4	0	0	0	5 (1)	1	0	0	0	2	0
Chesterfield Canal, S Yorkshire & Nottinghamshire (23) 11.5km	0	0	0	2	0	0	0	2 (1)	0	0	5	0	18 (10)	1
Cromford Canal (13) 8.6km*	0	2	0	(+)	0	0	0	3 (2)	1	0	1	0	(+)	0

Dearne & Dove Canal (7) 4.3km†	0	0	0	4	0	0	0	2	0	0	0	0	3	1
Driffield Canal (5) 7.1km	0	0	0	3	0	0	1	0	0	0	0	0	2	0
Erewash Canal (4) 2.7km	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Grantham Canal (12) 6.0km	0	0	0	1	0	0	0	0	0	0	0	0	1	2
Huddersfield Broad Canal (12) 6.0km	0	0	0	1	0	0	0	11 (5)	6 (4)	0	0	1	(+)	0
Huddersfield Narrow Canal, Yorkshire (25) 12.5km	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Huddersfield Narrow Canal, Cheshire & Lancashire (9) 9.0km	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Knottingley & Goole Canal (7) 6.1km	0	1	0	0	0	0	0	0	0	0	1	1	3	0
Lancaster Canal, Cumbria & Lancashire (12) 6km	0	2	0	2	0	0	0	1	4	0	3	0	3	3
Leeds & Liverpool Canal (37) 29.3km	0	1	0	6	0	0	0	7	0	17 (2)	12	5	23 (4)	6
Leven Canal (5) 4.8km	0	0	0	0	0	0	2 (1)	0	0	0	0	0	1	0
New Junction Canal (5) 4.2km	0	0	0	2	0	0	0	1	1	0	0	0	5	0
Pocklington Canal (14) 7km	1	0	0	1	0	3	5 (3)	2	0	0	0	0	2	0
Ripon Canal (7) 3.5km	0	0	0	0	0	2	0	1	0	2	(+)	0	4 (1)	0
Selby Canal (17) 8.5km	0	0	0	7	0	0	0	4	0	0	6	0	8	1
South Yorkshire Navigations, Sheffield to Bramwith (14) 21.4km	0	0	0	5	0	0	0	8 (3)	0	0	0	0	9	0
Stainforth & Keadby Canal, Yorkshire & Lincolnshire (13) 23.8km	0	0	0	12 (1)	0	0	0	2	0	6 (5)	4	0	13 (2)	0

Values are number of lengths in which plants were recorded in the most recent survey (the number of lengths where they were dominant or abundant is shown in brackets); (+) indicates found since 2010 but not in the most recent survey; 0=not recorded. *Includes c.0.4km of the Cromford Canal at Langley Mill. †Includes 0.6km of the Dearne & Dove Canal at Swinton.

Discussion

The pondweeds most often recorded in this study, such as Fennel, Curled and Broad-leaved Pondweeds (Table 2), were found in most of the canals visited (Table 1, p47) and there was no obvious geographical bias in their distribution. They occur throughout Yorkshire in a wide range of rivers and other water bodies (Crackles, 1990; Lavin & Wilmore, 1994; Abbott, 2005; Wilmore, Lunn & Rodwell, 2011) and this is reflected by their widespread distribution in canals. Other pondweeds, while not uncommon in canals, had an uneven geographical distribution. Perfoliate Pondweed was the fifth most frequently encountered, found in 8.4% of canal lengths and dominant/abundant in 2.4% of them (Tables 2 & 3, p54) but its distribution in canals was uneven. It was conspicuous in the Leeds & Liverpool, Ripon and Stainforth & Keadby Canals but was notably absent from canals in East Yorkshire. The distribution of Shining Pondweed was also uneven; this plant was found only in East Yorkshire where it occurred in the Driffield, Leven and Pocklington Canals. Some other pondweeds were very locally distributed. Opposite-leaved Pondweed was recorded only in the Pocklington Canal, Grass-wrack Pondweed only in the Erewash Canal and American Pondweed only in the Calder & Hebble Navigation.

Table 2. Pondweeds recorded 2010-2019 ranked in order of frequency

Pondweed	**n of records**	**% of lengths with records**
Stuckenia pectinata Fennel Pondweed	102	34.5
Potamogeton crispus Curled Pondweed	55	18.6
P. natans Broad-leaved Pondweed	55	18.6
P. pusillus Lesser Pondweed	36	12.2
P. perfoliatus Perfoliate Pondweed	25	8.4
Zannichellia palustris Horned Pondweed	14	4.7
P. obtusifolius Blunt-leaved Pondweed	13	4.4
P. trichoides Hairlike Pondweed	10	3.4
P. lucens Shining Pondweed	8	2.7
P. berchtoldii Small Pondweed	7	2.4
P. friesii Flat-stalked Pondweed	6	2.0
P. compressus Grass-wrack Pondweed	2	0.7
P. epihydrus American Pondweed	2	0.7
Groenlandia densa Opposite-leaved Pondweed	1	0.3

Values are the number of canal lengths in which pondweeds were recorded (most recent visits only) and % of total lengths (n=296) with records.

The success of a pondweed in a specific canal likely depends upon its ability to reach and colonise the site, and then upon environmental conditions continuing to favour its growth and survival. There are several ways by which aquatic plants might reach a canal (Goulder, 2014a). These include (1) colonisation by the native aquatic flora of the landscape through which canals were excavated, (2) migration of aquatic plants along the canal system and (3) unexpected introductions mediated through seemingly-random natural events (e.g. transport of seeds by water fowl) or through deliberate or inadvertent human intervention (e.g. the intentional release of exotic plants originally imported by the ornamental horticulture trade and escapes from garden ponds or ornamental lakes, perhaps during flood events).

The pondweeds most often found in this study, i.e. Fennel Pondweed, Curled Pondweed and Broad-leaved Pondweed, were frequent and widespread in a wide range of freshwater habitats throughout Yorkshire in the 19th century (Lees, 1888; Robinson, 1902: Baker, 1906). Very likely these plants colonised the canals soon after they were built, originating from the landscape through which the canals were excavated or from loose plants carried along the canals by currents or boat movements. Thus, Fennel Pondweed was recorded in the 19th century in the Selby Canal, the Calder & Hebble Navigation, the Leeds & Liverpool Canal, and the Chesterfield Canal in South Yorkshire, while Curled Pondweed was in the Barnsley Canal, the Leeds & Liverpool Canal, the Ripon Canal, and the Sheffield & Tinsley Canal (Lees, 1888). Additionally, should these widespread pondweeds have been for a while lost from a canal because of vagaries of management, maintenance and usage, they will have been able readily to recolonise because of their presence in neighbouring fresh waters.

The uneven distribution of other pondweeds in canals may reflect their similarly uneven distribution in the wider landscape. If a pondweed occurs in a canal's feeder rivers or reservoirs and/or in neighbouring water bodies, then it is more likely to be able to reach and colonise that canal. Thus Perfoliate Pondweed, a feature of the Leeds & Liverpool Canal, the Ripon Canal and the Stainforth & Keadby Canal, is widely distributed in West Yorkshire and the East Midlands (Preston *et al.*, 2002) and occurs in West Yorkshire rivers (Lavin & Wilmore, *loc. cit.*; Abbott, *loc. cit.*), whereas it is regionally rare in East Yorkshire (Middleton & Cook, 2015) and was not found there in canals. In contrast, Shining Pondweed which was found in East Yorkshire Canals but not in canals elsewhere, has a largely southern and eastern distribution in England; it is largely absent from West and South Yorkshire but is widespread in East Yorkshire (Preston *et al., loc. cit.*), where it is frequent in the Rivers Derwent and Hull (Crackles, *loc. cit.*). Similarly, Flat-stalked Pondweed has a largely eastern and southern national distribution and in Yorkshire canals (except for an outlier in the Ripon Canal) is confined to East Yorkshire, where it was found in the canal known as Beverley Beck and in the Pocklington Canal; it has also relatively recently been recorded in the Driffield Canal (in 2002; Goulder, 2003) and the Leven Canal (in 2005; Goulder, 2006). Preston *et al. (loc. cit.)* suggest that this is a plant that initially colonised canals nationally but later declined. In East Yorkshire it is found in both drains and canals (Goulder, 2008) and, with more than ten records since 1990, is regionally secure although nationally rare (Middleton & Cook, *loc. cit.*). The East Yorkshire metapopulation of this plant may be derived from an ancient native population that existed before the drainage of extensive wetlands and the excavation of drains and canals. The Ripon Canal outlier represents a long-standing population. Sledge (1985) refers to 1940s records of Flat-stalked Pondweed in that canal and he found it to be frequent there in the mid-1980s; I found it in 2011 (Goulder, 2013) and again in 2017 (Goulder, 2019a).

Some pondweeds were very rarely encountered, being found in one or two lengths and in only one canal. These perhaps represent two categories: (1) relics of a formerly more widespread distribution or (2) isolated populations, perhaps having arisen from an unexplained introduction.

In the first category is Grass-wrack Pondweed (Figure 4, p52), historically a canal plant but found in this study only in the Erewash Canal at Langley Mill. It is nationally in long-term decline (Preston *et al., loc. cit.*) and is endangered in England (Stroh *et al.*, 2014). It occurred in the western end of the Huddersfield Narrow Canal prior to its late 20th century restoration (Anon., 1996; Natural England, undated). The Cromford Canal had Grass-wrack Pondweed in the 19th

century (Linton, 1903) and into the 20th (Clapham, 1969; Willmot & Moyes, 2015) but I failed to find it in 2013 or 2015 (Goulder, 2014a, 2017a). There is a 1979 record for the Sheffield & Tinsley Canal (Shaw, 1988) but it was not found in later surveys (e.g. Gilbert 1995; Goulder, 2017b). It was recorded in the non-navigable Grantham Canal in 2007 (Jeeves, 2011) although I did not find it in 2015 along 6.0km of SSSI canal between Harby and Redmile (Goulder, 2017a). Grass-wrack Pondweed has been identified by Natural England (Birkinshaw *et al.*, 2013) as a candidate for conservation reintroductions. This was attempted in May 2015 in the Grantham Canal at Redmile, which had been dredged in late 2014, with the hope of creating a more open channel and encouraging plant diversity. Plants sourced from the Erewash Canal rooted in weighted hessian bags were used. I was invited to visit the site in June 2017 by ecologists Martin Banham (Natural England) and Imogen Wilde (CRT); we searched for but could not find the plant – the channel had been colonised by highly aggressive Water-soldier *Stratiotes aloides* beneath which was much Rigid Hornwort *Ceratophyllum demersum* – the reintroduced Grass-wrack Pondweed had apparently succumbed to competition.

Similarly, Opposite-leaved Pondweed (Figure 5, p52) was found at only one site which was on the Pocklington Canal. It is declining nationally (Preston *et al., loc. cit.*) and is vulnerable in England (Stroh *et al., loc. cit.*). It used to be in the Cromford and Chesterfield Canals (Clapham, *loc. cit.*). In East Yorkshire it was formerly in the Driffield Canal (Sledge, 1960) and in the navigable River Hull (Goulder, 2019b). It has been recorded intermittently in surveys of the Pocklington Canal, i.e. in 1986 (Tolhurst, 1987), 1990 (Head, 1991) and 1996 (Anon., 1997). I failed to find this plant in 2002, 2013 and 2015 (Goulder, 2003, 2014b, 2017c) but was pleased to find it in 2019 – a patch c.1m x 1.5m plus a few other scattered plants.

American Pondweed (Figure 6, p52) falls into the second category. It was found by A.E. Vigurs in 1907 in the canal at Salterhebble near Halifax, adjacent to the discharge from a cotton spinning mill (Bennett, 1908a). OS maps from the 1890s to the 1930s show a cotton mill at SE097229 c.0.5km along the Halifax Cut from its junction with the main line of the Calder & Hebble Navigation. In the following year Vigurs also found the plant in the main line of the canal between Salterhebble and Elland (Bennett, 1908b). The plant continues to thrive in the canal between Salterhebble and Sowerby Bridge (Goulder, 2015, 2019a). Although American Pondweed has been known as a UK native in lochans in the Hebrides since the early 1940s (Preston & Croft, 1997) the canal population presumably represents an introduction of North American material by unknown means. Vigurs (Bennett, 1908b) suspected the cotton mill effluent as a likely source but this might be a 'red herring'.

Whether or not pondweeds thrive once they have reached canals is likely to depend upon a range of environmental variables, which are often inter-dependent. These include:

Availability of inorganic nutrients and biological richness of sites. Fresh waters range from being biologically poor (oligotrophic) with limited availability of inorganic nutrients (such as nitrogen and phosphorus) to biologically rich (eutrophic) with greater nutrient availability. The canals visited in this study tended more towards the eutrophic end of the spectrum, being lowland waterways fed from rivers and streams that receive run-off from agricultural land and that are also likely to receive nutrient-rich treated effluent from sewage works. Some canals also have discharges in rainy weather from combined sewer overflows; Driffield Sewage Works discharges treated effluent into the Driffield

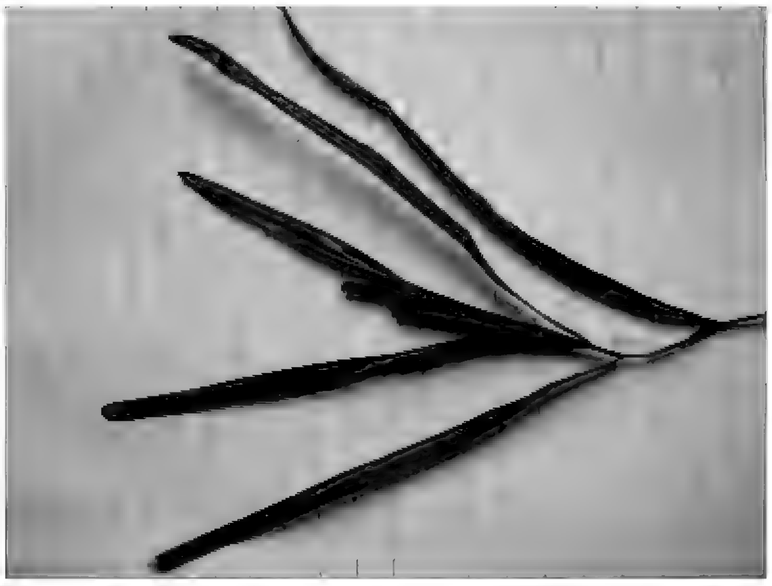

Figure 4. Grass-wrack Pondweed *Potamogeton compressus* from the Erewash Canal at Langley Mill, August 2017. The lines in the notebook are 8mm apart.

Figure 5. Opposite-leaved Pondweed *Groenlandia densa* from a non-navigable length of the Pocklington Canal near Pocklington, June 2019. The lines in the notebook are 8mm apart.

Figure 6. American Pondweed *Potamogeton epihydrus* in the Calder & Hebble Navigation between Salterhebble and Sowerby Bridge, July 2018. The plant has both floating leaves and submerged ribbon-like leaves.

Canal. Furthermore, sediments accumulate in canals and pondweeds, being rooted in these, can source inorganic nutrients from both surrounding water and sediments (Denny, 1972).

Parallel to this, most canal pondweeds are plants with an eco-physiology that favours richer habitats. This is shown by their Ellenberg's Nitrogen (E_N) values (Hill *et al.*, 1999). These values indicate the richness of the habitat in which plants are most likely to be found; they range from one, indicating plants of extremely infertile sites, to nine for plants of extremely rich conditions. Most canal pondweeds have relatively high E_N values; 11 of the 14 pondweeds recorded have an E_N value of five or more, including Fennel and Horned Pondweeds with E_N=7+. Only Grass-wrack, Broad-leaved and American Pondweeds have an E_N value of four or less. Because of the generally eutrophic state of canals, it seems unlikely that pondweeds are excluded from many, if any, canal sites because of an absolute lack of inorganic nutrients. On the contrary, they are perhaps more likely to be lost because of enrichment; for example, Opposite-leaved Pondweed

(Walker *et al.*, 2017) and Grass-wrack Pondweed and Red Pondweed *Potamogeton alpinus* (Preston & Croft, *loc. cit.*) appear to be susceptible to eutrophication.

pH and alkalinity. Richer sites also tend to have pH around neutral or tending to slightly alkaline and they tend towards high dissolved bicarbonate (HCO_3^-) concentration. This is especially so if they are calcareous, being supplied by water that runs off catchments with limestone or chalk, as with the Leeds & Liverpool Canal and canals in East Yorkshire. As pH increases, dissolved inorganic carbon shifts from carbon dioxide gas to bicarbonate ions (e.g. Wetzel, 2001). Some submerged plants are better than others at using this bicarbonate as a carbon source for photosynthesis and these plants are likely to be favoured in Yorkshire's canals. Spence & Maberly (1985) list several of the pondweeds found in Yorkshire canals as being capable of using bicarbonate (i.e. Curled, Shining, Fennel, Perfoliate, Lesser and Horned pondweeds) whereas the only non-bicarbonate user found in Yorkshire canals that they list is Broad-leaved Pondweed, and that is a plant which, because of its floating leaves, may be able to access atmospheric CO_2. Some pondweeds are calcicoles, being specifically associated with calcareous waters; Shining Pondweed is amongst these (Preston & Croft, *loc. cit.*) and this is reflected in its distribution, being found only in the calcareous canals of East Yorkshire. These are waterways that are fed by water from the chalk of the Yorkshire Wolds.

Boat traffic. The classic work on the effects of boats on canal plants is that of Murphy & Eaton (1983); they demonstrated loss of vegetation at high levels of boat traffic because of water turbidity and mechanical damage. Lately, I have reviewed the effects of boat traffic on plants in canals (Goulder, 2019a). At low and intermediate traffic levels pondweeds are sometimes abundant and a good number of species may be found. Traffic may be heavy enough to prevent encroachment into the navigable channel by emergent marginal plants yet be insufficient to cause prolonged turbidity, allowing continued light penetration and underwater photosynthesis. Nor is mechanical damage of plants by boats too severe. Thus, for example, in the Leeds & Liverpool Canal along c.16.6km (21 lengths) in 2015 and 2016 between central Leeds and Bingley, eight pondweeds were found (Goulder, 2016a, 2019a). These were Small, Curled, Broad-leaved, Fennel, Perfoliate, Lesser, Hairlike and Horned pondweeds. Furthermore, Fennel Pondweed was dominant/abundant in four lengths and Perfoliate Pondweed in two lengths. Likewise, in the restored western (downstream) end of the Pocklington Canal, which has very little boat traffic, Shining Pondweed is notable for its luxuriance. In summer 2013 it was recorded in four out of six 0.5km lengths surveyed and was dominant/abundant in three of them. Also found were Flat-stalked, Broad-leaved and Fennel Pondweeds (Goulder, 2019a).

In contrast, in canals with heavy boat traffic and persistent high turbidity, submerged plants including pondweeds tend to be sparse or absent. For example, the Leeds & Liverpool Canal west of Skipton runs through the attractive countryside of rural Airedale and attracts many boaters. Canal & River Trust records show that Stegneck Lock on this section was used 2102 times in 2019 (Canal & River Trust, 2020) and this is an underestimate of the number of boats using the canal; narrow boats can go through locks in pairs, also boats can pass both up and down at a single lock usage. Furthermore, especially around Skipton, there are trip boats and boats for hire by the day that often

do not pass through locks. Thus, in summer 2016, only three pondweeds were found in 15 lengths along c.12.4km of canal from Skipton, through Gargrave to Langber, and these were sparsely distributed; Fennel Pondweed was occasional/rare in three lengths, Lesser Pondweed was occasional/rare in two lengths and Horned Pondweed was occasional/rare in two lengths and frequent in one length (Goulder, 2016b, 2019a).

Preston (*loc. cit.*) suggests that Broad-leaved Pondweed, with its floating leaves (Figure 7, p56), is more vulnerable to boat traffic than other pondweeds and that its distribution in canals is, therefore, less widespread than might be anticipated from its extensive distribution in the wider landscape. Notwithstanding this caveat, Broad-leaved Pondweed was the third most frequently encountered pondweed in my study. It was recorded in 18.6% of lengths (Table 2, p49) and was dominant/abundant in 4.7% of these (Table 3); it was found in 16 out of 23 canals visited. Unsurprisingly, it sometimes thrived in canals that are no longer navigated, being dominant/abundant in some lengths of the Barnsley and Cromford Canals. However, it was also sometimes dominant/abundant in canals with moderate boat traffic, for example, in some lengths of the Huddersfield Broad Canal and in the South Yorkshire Navigations between Sheffield and Rotherham. The key to this is probably that these are relatively wide waterways and there is space enough to allow the passage of narrow boats without great damage to floating-leaved plants along the edges of the navigable channel.

Table 3. Records of Pondweeds as dominant or abundant ranked in order of frequency.

Pondweed	n of records	% of lengths with records
Stuckenia pectinata Fennel Pondweed	18	6.1
Potamogeton natans Broad-leaved Pondweed	14	4.7
P. perfoliatus Perfoliate Pondweed	7	2.4
P. lucens Shining Pondweed	4	1.4
P. obtusifolius Blunt-leaved Pondweed	4	1.4
P. crispus Curled Pondweed	1	0.3

Values are the number of canal lengths in which pondweeds were recorded as dominant/abundant (>c.5% cover) (most recent visits only) and % of total lengths (n=296) with dominant/abundant records.

Shading by trees. Canals are sometimes heavily shaded by trees, for example the Leeds & Liverpool Canal and canal sections of the Calder & Hebble Navigation as they climb the often-wooded valleys of the Rivers Aire and Calder. Aquatic plants, including pondweeds, are often suppressed by shading. Thus, in 2015 Perfoliate Pondweed was recorded in eight of nine lengths along c.8.4km of the Leeds & Liverpool Canal, much of it within the deciduous woodlands of the Kirkstall Valley west of Leeds. The plant, however, achieved frequent status only in three less-shaded lengths, never being dominant or abundant (Goulder, 2016a,c, 2017d). In contrast, in the largely-unshaded canal in central Leeds, in 2016, Perfoliate Pondweed, which was found in four lengths along c.1.9km of canal between River Lock and Spring Garden Lock, was dominant/abundant in two lengths and frequent in the other two. Indeed, this section of canal is an especially good place to find pondweeds; it also had Curled, Broad-leaved, Fennel,

Lesser and Hairlike Pondweeds (Goulder, 2016b). It is immediately accessible on foot from the Granary Wharf exit of Leeds railway station.

Competition with other water plants. Extensive growth of emergent vegetation in canals leads to suppression and exclusion of submerged and floating-leaved plants, including pondweeds. This process is most frequently seen in canals that are no longer navigated and where emergent vegetation is unchecked. For example, at Pocklington, c.200m of canal between Canal Head and Top Lock is intermittently dredged, and in 2019 and earlier years Curled and Fennel Pondweeds were thriving whereas immediately downstream of the lock Reed Sweet-grass *Glyceria maxima* (a typically abundant emergent plant in non-navigated canals) occupied virtually all the channel, water depth was reduced to a few centimetres and pondweeds and other submerged and floating-leaved plants were essentially absent. Similar observations were made along the Barnsley and Dearne & Dove Canals (Goulder, 2019a). Pondweeds were found where water level was maintained to facilitate angling – Curled, Broad-leaved, Fennel and Horned Pondweeds – but were absent where Reed Sweet-grass had grown to occupy the whole channel.

Sometimes there are substantial stands of pondweeds that appear to be holding their own with or outcompeting other submerged and floating-leaved plants. Examples seen were Broad-leaved Pondweed that dominated the channel of Wigwell Aquaduct on the Cromford Canal (Goulder, 2017a), Blunt-leaved Pondweed that formed extensive beds in parts of the Huddersfield Broad Canal (Goulder, 2020a) and extensive beds of Shining Pondweed in the navigable Pocklington Canal and of Perfoliate Pondweed in central Leeds in the Leeds & Liverpool Canal (Goulder, 2019a). Often, however, pondweeds are a minor component of the submerged and floating-leaved flora, being subservient to other, more vigorous, plants. For example, the Selby Canal in summer 2012 had clear water and abundant submerged and floating-leaved plants (Goulder, 2014c).

Plants were recorded along seventeen 0.5km lengths. Yellow Water-lily *Nuphar lutea* was especially luxuriant, being dominant/abundant in all lengths; its floating leaves occupied the margins of the channel while its underwater ’cabbage’ leaves cloaked the bed of the canal. The trailing leaves of Unbranched Bur-reed *Sparganium emersum* were also conspicuous; this plant being dominant/abundant in 12 lengths. Amidst this luxuriance, pondweeds appeared to suffer from competition. Five were found (Curled, Broad-leaved, Fennel, Lesser and Horned Pondweeds) but all were recorded as occasional/rare except for one length with frequent Fennel Pondweed and two lengths with frequent Lesser Pondweed).

In extreme circumstances, competition from other submerged and floating-leaved plants can virtually eliminate pondweeds. Thus, the non-navigable Grantham Canal was once well-known for its diverse pondweeds that included Broad-leaved, Fennel, Perfoliate, Curled and Grass-wrack Pondweeds (Pitman, 2007) and additionally Flat-stalked, Lesser and Blunt-leaved Pondweeds (Anon., 2007; Evans, 2015). However, when I surveyed twelve 0.5km lengths of the Grantham Canal SSSI in 2015 (Goulder, 2017a), pondweeds were very sparse. Curled Pondweed (one plant found) and Fennel Pondweed were each occasional/rare in one out of 12 lengths and Horned Pondweed

was occasional/rare in two lengths; no others were found. This was probably because of extreme competition from other floating-leaved/submerged plants. Water-soldier was dominant/abundant in ten lengths; its free-floating rosettes occupied all or most of the central channel between dense margins of emergent plants, the aggressive Rigid Hornwort was also often abundant while any gaps were filled by Common Duckweed *Lemna minor* and Ivy-leaved Duckweed *Lemna trisulca*.

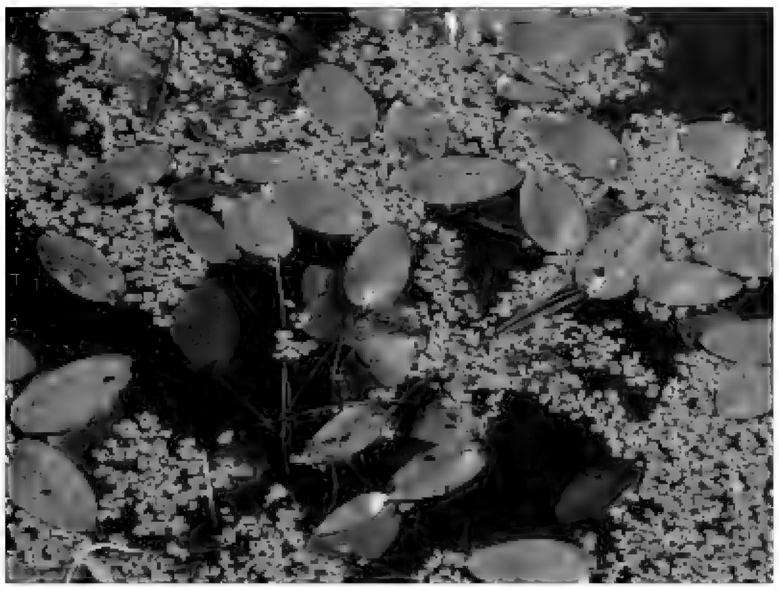

Figure 7. Floating leaves of Broad-leaved Pondweed *Potamogeton natans* in the South Yorkshire Navigations at Ickles Lock, Rotherham, with Greater Duckweed *Spirodela polyrhiza* and Common Duckweed *Lemna minor*, September 2013.

Figure 8. A grapnel haul of Blunt-leaved Pondweed *Potamogeton obtusifolius* from the Huddersfield Broad Canal in Huddersfield, August 2019.

Maintenance and management. It is apparent from the above that many of the variables that bear upon pondweeds are related to canal maintenance and management; nutrient enrichment, the effects of boating, shading by trees and competition from other aquatic plants all, to a degree, depend on how canals are managed and maintained. When navigation has ceased and management consists of benign neglect, then pondweeds may be lost because of siltation, loss of water depth and encroachment of other vegetation, as described above in the Grantham and Pocklington Canals. On the other hand, if canals are dredged to benefit navigation then pondweeds and other water plants will inevitably suffer, at least in the short term. However, a report by the Inland Waterways Advisory Council (IWAC, 2008) suggested that there may be long-term benefits of dredging to some aquatic plants. This is because of restoration of open-water conditions and reduction of competition from encroaching emergent plants; pondweeds are likely to be among the beneficiaries. An exploration of the long-term effect of a major dredge of the whole of the Huddersfield Broad Canal in 2002 was made possible through consultation of plant records from c.20 years before dredging, immediately before dredging, and 10-20 years afterwards (Goulder, 2020a). That study showed gains as well as losses. Before dredging, Broad-leaved, Small and Curled Pondweeds were widespread and Fennel Pondweed was also recorded. After dredging these plants were still to be found (except for Small Pondweed) and Broad-leaved Pondweed was dominant/abundant in several lengths. Pondweeds apparently new to the canal were Blunt-leaved, especially conspicuous in some lengths in 2019

(Figure 8, p56) and Hairlike Pondweeds.

Where open water free of competing emergent plants is maintained for navigation, the depth of water is liable to be significant to the success of pondweeds. Light energy, necessary for photosynthesis, decreases exponentially (logarithmically) with depth and so rapidly decreases as depth increases (e.g. Wetzel, *loc. cit.*). The navigable channels of Yorkshire's canals are usually relatively shallow, for example the maximum draught for boats is 1.22m on the Pocklington Canal, 1.15m on the Leeds & Liverpool Canal and 1.4m on the Huddersfield Broad Canal (Canal & River Trust, undated) and it is in such canals that pondweeds are likely to be abundant. However, the canals that are available to commercial navigation are much deeper; maximum draught for the Aire & Calder Navigation, the New Junction Canal and the South Yorkshire Navigations from Bramwith to Mexborough is 2.5m. Nevertheless, notwithstanding the greater depth, rooted pondweeds were observed in these canals although they were rather sparse. For example, the Knottingley & Goole Canal (Aire & Calder Navigation) and the New Junction Canal, when visited in September 2016, between them yielded Curled, Broad-leaved, Blunt-leaved, Fennel, Lesser, Small, and Hairlike Pondweeds, although only Fennel Pondweed achieved as much as frequent status – in three out of five lengths of the New Junction Canal (Goulder, 2017e). Given that these wide and deep waterways are now used virtually only by leisure boats and many of these craft are narrow boats which are small relative to the infrastructure of such canals, it will be interesting to see how pondweeds develop in these spacious and not much disturbed habitats in which there is relatively little competition from other submerged plants.

Although pondweeds were frequently encountered in the canals of Yorkshire and neighbouring counties, and in some they were very abundant, it must be emphasised that there were many lengths of canal in which pondweeds were sparse or not found at all. Out of 296 lengths surveyed none were recorded in 123 lengths (41.6%). Sometimes the reason for a dearth of pondweeds was immediately obvious, for example competition from other submerged and floating-leaved plants as in the Grantham Canal (see above). In other canals the reason is not so immediately evident but lies in the history of the site. For example, when I surveyed the c.12.5 km of the Huddersfield Narrow Canal east of Standedge Tunnel in 2012 (Goulder, 2012; Goulder & Morphy, 2013) submerged and floating-leaved plants were generally sparse and the only pondweed encountered was Curled Pondweed. This was a single shoot retrieved by one out of more than 500 untargeted grapnel hauls – and that was from a winding hole (a broad place where boats are turned) rather than the main channel. Similarly, west of Standedge Tunnel, when c.9.3km of SSSI canal were surveyed in 2015 (Goulder, 2016a) the only pondweeds found were a few plants of Small Pondweed and a bed of Curled Pondweed in a small, off-line, former dock. This canal underwent extensive civil engineering works during the final 20 years of the 20th century that led to its reopening to leisure navigation in 2001 (Gibson, 2002). Before restoration the aquatic vegetation was richer than now. It included Curled, Broad-leaved and Small Pondweeds east of Standedge Tunnel (Morphy *et al.*, 1980), while west of the tunnel there were records of Grass-wrack, Shining, Broad-leaved, Fennel, Perfoliate, Long-stalked *Potamogeton praelongus* and Hairlike Pondweeds (see references in Goulder, 2016a). It appears that the restoration was so 'root and branch' that the submerged flora was lost and, although water chemistry presumably continues to be favourable, it has largely not yet recolonised.

Indeed, there are many instances where pondweeds were once recorded in canals but I did not find them. For example, when surveying SSSIs in 2015, I did not record: Blunt-leaved Pondweed in the Leeds & Liverpool Canal; Small, Perfoliate or Linton's *Potamogeton x lintonii* Pondweeds in the Chesterfield Canal; Grass-wrack, Lesser or Various-leaved *Potamogeton gramineus* Pondweeds in the Cromford Canal; Flat-stalked, Broad-leaved, Blunt-leaved or Lesser Pondweeds in the Grantham Canal; Red, Curled, Flat-stalked or Broad-leaved Pondweeds in the Leven Canal; nor Small, Lesser or Horned Pondweeds in the Pocklington Canal. All these have at some time previously been recorded in the respective canals (see references in Goulder, 2016a, 2017a, c).

However, to set against this catalogue of likely losses, there are some encouraging re-discoveries and increases in abundance. These include Opposite-leaved Pondweed last seen in the Pocklington Canal in 2009 (Middleton & Cook, *loc. cit.*) but re-found in 2019 (see above), and the great increase in abundance of Blunt-leaved Pondweed in the Huddersfield Broad Canal at Huddersfield from an apparent absence before the canal was dredged in 2002, to a few shoots retrieved by grapnel hauls in 2012, to great abundance in 2019 (Goulder & Morphy, *loc. cit.*; Goulder 2020a). Also, when a non-navigated length of the Pocklington Canal immediately upstream of Thornton Lock, that had become entirely overgrown by Reed Sweet-grass and/or Common Reed *Phragmites australis*, was cleared of these emergent plants in winter 2014-2015, the submerged and floating-leaved plants that came to occupy the newly-open channel included Shining Pondweed and Broad-leaved Pondweed (Goulder, 2017c). Additionally, when I searched diligently for narrow-leaved pondweeds in the Leeds & Liverpool Canal in central Leeds in 2011 I failed to find Hairlike Pondweed (Goulder, 2013), whereas it was easily found in 2016 (Goulder, 2019a) and was still there in 2019. It is hoped that positive news of pondweeds will continue.

Acknowledgements
I thank the many helpful people who have offered information and support. Amongst them are Phillippa Baron, Jonathan Hart-Woods, Thomas King, Tom Rayward, Diane Rollin and Imogen Wilde of the Canal & River Trust, Martin Banham, Simon Christian, Michelle Dickinson, Brian Dunning, Ian Evans, Michael Holding, Chris McGregor and Mark Taylor of Natural England, Tom French and Rick Jillings of Derbyshire County Council, George Draper of Trailer & Marina (Leven), Paul Caygill the Beverley Beck bailiff and Alistair Anderson of the Pocklington Canal Amenity Society.

References
Abbott, P.P. (2005) *Plant Atlas of Mid-west Yorkshire*. Yorkshire Naturalists' Union, York.
Anon. (1996) *Huddersfield Narrow Canal: a Review of Nature Conservation Issues.* A report by Penny Anderson Associates, Buxton for British Waterways.
Anon. (1997) *Pocklington Canal Macrophyte Survey*. A report by Scott Wilson Resource Consultants, Leeds for British Waterways and English Nature.
Anon. (2006) *Waterways Guide 6: Nottingham, York & the North East. New edition*. Nicholson, London.
Anon. (2007) *Grantham Canal Habitat Impact Study: Appendix 1 – Ecological Survey Report*. A report by ECUS, Sheffield for the Grantham Canal Partnership, c/o British Waterways, Newark.
Anon. (2009) *Waterways Guide 5: North West & the Pennines. New edition.* Nicholson,

Cheltenham.
Baker, J.G. (1906) *North Yorkshire: Studies of its Botany, Geology, Climate and Physical Geography. Second edition*. Brown, London and Hull.
Bennett, A. (1908a) *Potamogeton pensylvanicus* in England. *The Naturalist* 33: 10-11.
Bennett, A. (1908b) The Halifax *Potamogeton*. *The Naturalist* 33: 373-375.
Birkinshaw, N., Kemp, E. & Clarke, S. (2013) *The ecology of Grass-wrack Pondweed Potamogeton compressus*. Natural England Commissioned Reports No. 130. http://publications. naturalengland.org.uk/publication/ 4709611760254976.
Briggs, J. (1996) Canals – wildlife value and restoration issues. *British Wildlife* 7: 365-377.
Briggs, J. (2006) The saga of the Montgomery Canal. *British Wildlife* 17: 401-410.
Briggs, J. (2012) Canals under new management: a review of wildlife value, issues and opportunities. *British Wildlife* 23: 314-323.
Canal & River Trust (2020) Annual Lockage Report 2019. https://canalrivertrust.org.uk/media/ original/41295-annual-lockage-report-2019.pdf?v=cdabd6.
Canal & River Trust (undated) Waterway Dimensions. https://canalrivertrust.org.uk/media/ original/32433-waterway-dimensions.pdf.
Clapham, A.R. (1969) *Flora of Derbyshire*. County Borough of Derby Museum & Art Gallery, Derby.
Crackles, F.E. (1990) *Flora of the East Riding of Yorkshire*. Hull University Press & Humberside County Council, Hull.
Denny, P. (1972) Sites of nutrient absorption in aquatic macrophytes. *Journal of Ecology* 60: 819-829.
Evans, I. (2015) *Grantham Canal SSSI*. An unpublished list of plants recorded in the SSSI by several surveys between 1975 and 2006; provided by Ian Evans, Natural England, Worcester.
Gibson, K. (2002) *Pennine Dreams: the Story of the Huddersfield Narrow Canal.* Tempus Publishing, Stroud.
Gilbert, O. (1995) Botanical changes on the Sheffield Canal 1984 to 1995. *Sorby Record* 31: 91-94.
Goulder, R. (2002) Aquatic plants at North Cave Wetlands, a new Yorkshire Wildlife Trust reserve comprising former gravel workings. *The Naturalist* 127: 57-64.
Goulder, R. (2003) Aquatic plants in the Pocklington and Driffield canals with regard to the potential extension of navigation. *The Naturalist* 128: 129-146.
Goulder, R. (2006) Aquatic plants in the Leven Canal, East Yorkshire: does the waterway continue to be an important site for botanical conservation? *The Naturalist* 131: 77-82.
Goulder, R. (2008) Conservation of aquatic plants in artificial watercourses: are main drains a substitute for vulnerable navigation canals? *Aquatic Conservation: Marine and Freshwater Ecosystems* 18: 163-174.
Goulder, R. (2012) *Aquatic Plants in the Huddersfield Canals in 2012 and Change Since 1978-1985.* A report for the Canal & River Trust, Leeds.
Goulder, R. (2013) Aquatic plants in Yorkshire canals. *The Naturalist* 138: 4-16.
Goulder, R. (2014a) Understanding the history of aquatic plants in canals: the example of the Chesterfield and Cromford canals in Derbyshire. *Journal of the Railway & Canal Historical Society* 38: 182-192.
Goulder, R. (2014b) Aquatic plants in the Pocklington Canal: a decade of change. *The Naturalist* 139: 129-140.
Goulder, R. (2014c) Aquatic plants in the Selby Canal: a reflection of Humberhead-Levels vegetation or a distinct canal flora? *Thorne & Hatfield Moors Papers* 9: 21-34.
Goulder, R. (2015) Aquatic plants in the Calder & Hebble Navigation: distribution and conservation value. *The Naturalist* 140: 165-177.
Goulder, R. (2016a) Freshwater plants and SSSI canals in the East Midlands and North of England 1: Leeds & Liverpool Canal and Huddersfield Narrow Canal. *The Naturalist* 141: 169-185.

Goulder, R. (2016b) *Aquatic Plants in the Leeds & Liverpool Canal During Summer 2016*. A report for the Canal & River Trust, Leeds.
Goulder, R. (2017a) Freshwater plants and SSSI canals in the East Midlands and North of England 2: Chesterfield Canal, Cromford Canal and Grantham Canal. *The Naturalist* 142: 15-32.
Goulder, R. (2017b) Aquatic plants in the South Yorkshire Navigations: distribution and conservation value. *Thorne & Hatfield Moors Papers* 10: 1-25.
Goulder, R. (2017c) Freshwater plants and SSSI canals in the East Midlands and North of England 3: Leven Canal and Pocklington Canal. *The Naturalist* 142: 104-116
Goulder, R. (2017d). Freshwater plants and SSSI canals in the East Midlands and North of England 4: an overview. *The Naturalist* 142: 161-176.
Goulder, R. (2017e) Aquatic plants in two large-scale navigable waterways of the Humberhead Levels (Knottingley & Goole Canal and New Junction Canal). *Thorne & Hatfield Moors Papers* 10: 62-73.
Goulder, R. (2019a) Canals, Plants and People: a Yorkshire Perspective. PLACE, York.
Goulder, R. (2019b) Aquatic plants in the Driffield Navigation, East Yorkshire. *The Naturalist* 144:126-137.
Goulder, R. (2020a) Aquatic plants and dredging in the Huddersfield Broad Canal. *BSBI News* 143: 5-12.
Goulder, R. & Morphy, M.J. (2013) The response of aquatic plants to restoration and continuity of navigation in canals: the example of the Huddersfield canals. *BSBI News* 124: 7-15.
Hadfield, C. (1970) *The Canals of the East Midlands. Second edition*. David & Charles, Newton Abbot.
Hadfield, C. (1972) *The Canals of Yorkshire and North East England. Volume 1.* David & Charles, Newton Abbot.
Hadfield, C. (1973) *The Canals of Yorkshire and North East England. Volume 2.* David & Charles, Newton Abbot.
Head, R.M. (1991) *A Survey of the Aquatic Flora of the Pocklington Canal 1990: a Comparison with the NCC Survey of 1986*. A draft report prepared by British Waterways, Environmental and Scientific Services, Gloucester.
Hill, M.O., Mountford, J.O., Roy, D.B. & Bunce, R.G.H. (1999) *Ellenberg's Indicator Values for British Plants*. Institute of Terrestrial Ecology, Monks Wood, Huntingdon.
Holmes, N.T.H. (1983) *Focus on Nature Conservation No. 4: Typing British Rivers According to their Flora*. Nature Conservancy Council, Shrewsbury.
IWAC (2008) *Britain's Inland Waterways: Balancing the Needs of Navigation and Aquatic Wildlife*. Inland Waterways Advisory Council, London.
Jeeves, M. (2011) *The Flora of Leicestershire and Rutland: Checklist and Rare Plant Register*. Leicestershire & Rutland Wildlife Trust, Leicester.
Kaplan, Z. & Štěpánek, J. (2003) Genetic variation within and between populations of Potamogeton pusillus agg. *Plant Systematics and Evolution* 239: 95-112.
Lavin, J.C. & Wilmore, G.T.D. (1994) *The West Yorkshire Plant Atlas*. City of Bradford Metropolitan Council, Bradford.
Lees, F.A. (1888) *The Flora of West Yorkshire.* Reeve, London.
Linton, W.R. (1903) *Flora of Derbyshire*. Bemrose, London.
Middleton, R. & Cook, P.J. (2015) *South-east Yorkshire (vc61) Rare Plant Register. Third edition*. BSBI, London.
Morphy, M.J., Thomas, J. & Higgins, B. (1980) Macrophytes of the Huddersfield Narrow Canal – a preliminary survey. *The Naturalist* 105: 135-139.
Murphy, K.J. & Eaton, J.W. (1983) Effects of pleasure-boat traffic on macrophyte growth in canals. *Journal of Applied Ecology* 20: 713-729.

Natural England (undated) Huddersfield Narrow Canal, SSSI designation. https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1002803.pdf.
Pitman, T. (2007) *The Grantham Canal Guide*. Grantham Canal Society, Nottingham.
Preston, C.D. (1995) *Pondweeds of Great Britain and Ireland*. BSBI, London.
Preston, C.D. & Croft, J.M. (1997) *Aquatic Plants in Britain and Ireland*. Harley Books, Colchester.
Preston, C.D., Pearman, D.A. & Dines, T.D. (2002) *New Atlas of the British & Irish Flora*. Oxford University Press, Oxford.
Robinson, J.F. (1902) *The Flora of the East Riding of Yorkshire*. Brown, London and Hull.
Shaw, M. (1988) *A Flora of the Sheffield Area*. Sorby Natural History Society, Sheffield.
Sledge, W.A. (1960) Yorkshire Naturalists' Union excursions in 1960: Driffield, June 4th-6th, flowering plants. *The Naturalist* 85: 130-131.
Sledge, W.A. (1985) Pondweed records. *The Naturalist* 110: 147-148.
Spence, D.H.N. & Maberly, S.C. (1985) Occurrence and ecological importance of HCO_3^- use among aquatic higher plants in *Inorganic Carbon Uptake by Aquatic Photosynthetic Organisms*, eds W.J. Lucas & J.A. Berry: 125-143. American Society of Plant Physiologists, Rockville, Maryland.
Stace, C.A. (2019) *New Flora of the British Isles. Fourth edition*. C & M Floristics, Middlewood Green, Suffolk.
Stroh, P.A., Leach, S.J., August, T.A., Walker, K.J., Pearman, D.A., Rumsey, F.J., Harrower, C.A., Fay, M.F., Martin, J.P., Pankhurst, T., Preston, C.D. & Taylor, I. (2014) *A Vascular Plant Red List for England*. BSBI, Bristol.
Tolhurst, S.A. (1987) *A Survey of the Aquatic Flora of the Pocklington Canal, Yorkshire, 1986*. Nature Conservancy Council Contract Surveys No. 4, Peterborough.
Walker, K.J., Stroh, P.A. & Ellis, R.W. (2017) *Threatened Plants in Britain and Ireland*. BSBI, Bristol.
Wetzel, R.G. (2001) *Limnology: Lake and River Ecosystems. Third edition.* Academic Press, San Diego.
Willmot, A. & Moyes, N. (2015) *The Flora of Derbyshire*. Pisces Publications, Newbury.
Wilmore, G.T.D., Lunn, J. & Rodwell, J.S. (2011) *The South Yorkshire Plant Atlas.* Yorkshire Naturalists' Union, York.

Yorkshire sawflies: an update for the years 2003 – 2020

Ian Andrews
Email: syrphus@hotmail.co.uk

The last report on Yorkshire sawflies was John Coldwell's YNU Entomological Report for 1998-2001 (Coldwell, 2003). Twenty years of recording since the last update is not easy to summarise in a short article; inevitably there have been a number of new county and vice-county records in this period and these form the main part of this report.

Over the last year, the YNU record cards have been digitised and updated taxonomically. That job of updating the list has been complicated by many recent taxonomic changes. For example, following work by Prous *et al.* (2019) the nematine genus *Euura* has rocketed from 8 to 126 species (!), absorbing the former *Pachynematus*, *Amauronematus*, *Phyllocolpa* and *Pontania*, plus some of the *Nematus*. The overall changes are too many to list here, but some

familiar names within the Tenthredininae have also changed; for example, the large, common species *Rhogogaster viridis* Linnaeus, 1758, is now named *R.scalaris* Klug, 1817 and the scarce *Rhogogaster dryas* Benson 1943 now becomes *R.viridis* Linnaeus 1758, as the lectotype of *viridis* proved in fact to be that species (Taeger & Viitasaari, 2015). It is likely there will be more changes forthcoming, as much work on sawfly taxonomy is in progress across the channel.

The increased interest in sawflies generally within Europe has been shown in the past couple of years by the publication of new guides to sawflies in Italy (Pesarini 2019), in the Czech Republic (Macek *et al.* 2020) and finally, in November 2020, Jean Lacourt's *Sawflies of Europe* was published. This is the first English language guide with keys since Benson's 3-part RES guide in the 1950s. It looks to be very useful indeed and should encourage more people to attempt ID of sawflies. Frustratingly, Lacourt has not followed Prous *et al.* in their revision of the Nematinae and has not added much to Benson's earlier keys, so they remain as difficult as ever!

Several hundred records entered on iRecord by a variety of recorders have been checked and incorporated into the Yorkshire database (or weeded out, as necessary), as too a number of records from iNaturalist. I am especially grateful to Bill Dolling and Roy Crossley, who have each sent me a number of specimens for identification, and to John Coldwell for passing on records and information about Yorkshire sawflies and their status. Particular thanks also to Dave Chesmore for looking after the YNU records and passing on many records along with those. Andrew Grayson very kindly provided records from his study of invertebrates at Three Hagges Wood, which were much appreciated. Thanks also to all the others who have sent the odd specimen or have e-mailed records through to me. I am pleased to report that a once rather neglected family of insects in Yorkshire is now attracting far more attention than ever in the past. The popularity of web sites like iNaturalist and iRecord mean that members of the public now contribute records from across the county, rather than the database being limited just to the hardened band of recorders who have provided the bulk of the records held. While the number of species which can be confidently verified on such sites is relatively small, the contribution of them to our understanding of the distribution of species like *Arge pagana*, the Large Rose Sawfly, and *Phymatocera aterrima*, Solomon's-seal Sawfly, is not inconsiderable, and contact through those sites allows more Yorkshire symphytologists to be encouraged. A rather amusing aside to this record gathering via citizen science is that the Yorkshire records of the Greater Horntail *Urocerus gigas* now stand at 116, of which over 30 came through to iRecord in 2020 after being reported via the Non-native Species Alert online reporting form for Asian Hornets! The comments submitted with those make a most entertaining read on their own; for example, 'unsure if this is one or not but it was bloody massive!'.

The UK list for Symphyta stands at around 545 species. According to the records held, 369 of those have been recorded across the Yorkshire vice counties as at January 2021. The total for each VC is below. Those living in or visiting VC65 might like to note that a number of species are as yet unrecorded there; including, for example, such a common species as *Selandria serva*.

VC totals	VC 61: 259	VC 62: 257	VC 63: 293	VC 64: 280	VC 65: 120

New County and Vice County records since 2001

ɟ New county record

*New vice county record

CEPHIDAE

Subfamily Cephinae

Cephus spinipes Panzer, 1800

Larvae feed within stems of grasses, including *Phleum pratense*.

*VC65: Hutton Conyers 26.06.2012 C.H.Fletcher

Janus cynosbati Linnaeus, 1758

Larvae feed within terminal twigs of Quercus spp., creating a slight, spindle-shaped swelling.

*VC61: Calley Heath 20.05.2019 I.J.Andrews

PAMPHILIIDAE

Subfamily Pamphiliinae

Neurotoma saltuum Linnaeus, 1758

Larvae feed in communal webs on plants like *Crataegus* and *Prunus*.

*VC61: York University 17.06.2014 E.D.Chesmore

*VC64: Wheatlands Community Woodland, York 18.07.2013 E.D.Chesmore

Pamphilius balteatus Fallén, 1808

Larvae feed on *Rosa* spp.

*VC61: Allerthorpe Common 01.06.2018 I.J.Andrews

ARGIDAE

Subfamily Arginae

Arge berberidis Schrank, 1802 New to Yorkshire

Not recorded in the UK prior to 2002 (Halstead, 2004), but probably now widespread in Yorkshire, particularly in gardens where Mahonia, the larval foodplant is found; but, as records here show, they must disperse widely and can occur anywhere.

*VC61: Tophill Low 28.08.2019 J. Barnard

*VC62: Seivedale Fen 27.08.2019 I.J.Andrews

ɟVC63: Dalton 03.09.2012 G.Boyd

Arge gracilicornis Klug, 1814

Larvae feed on *Rubus idaeus*

*VC61: Meltonby 20.07.2019 I.J.Andrews

Arge ochropus Gmelin, 1790

Larvae feed on *Rosa* spp. and are not easy to tell apart from the larvae of the more common *A. pagana*. It does seem that *ochropus* is a species on the move north, though, and we might expect to see an increase in records similar to that seen in *pagana*?

*VC61: Wheldrake 19.07.2020 J.Small

*VC62: Crossgates Quarry, Eastfield 10.06.2020 D.Lombard

Arge pagana Panzer, 1797

Larvae feed on Rosa spp. Considered rare up to 2001, but now reported across Yorkshire with over 25 records in 2020 alone.

*VC62: Reighton 18.07.2018 D.Lombard

*VC63: Elsecar Colliery 11.06.2015 J.D.Coldwell

Subfamily Sterictiphorinae

Sterictiphora geminata Gmelin, 1790

Larvae feed on *Rosa* spp.

*VC61: Millington Pastures 16.05.2020 I.J.Andrews

CIMBICIDAE

Subfamily Abiinae

Abia aenea Klug, 1820 New to Yorkshire

Larvae feed on *Lonicera*. Very similar to the more common *Abia lonicerae*, but distinguished in specimens by the microsculpture on the body and the antennal form.

†VC63: Dalton, Huddersfield 17.04.2019 G.Boyd

Abia fasciata Linnaeus, 1758

Larvae feed on *Lonicera*.

*VC61: Elstronwick Brook Farm 15.07.2008 W.Dolling

*VC62: Seivedale Fen 13.07.2018 I.J.Andrews

Subfamily Cimbicinae

Cimbex connatus Schrank, 1776

Larvae feed on *Alnus* spp.

*VC62: Seivedale Fen 26.05.2014 I.J.Andrews

*VC63: Edlington 16.07.2017 J.Wilde

*VC65: Hutton Conyers 15.07.2020 C.H.Fletcher

Cimbex luteus Linnaeus, 1758

Larvae feed on *Salix* spp. (see Figure. 1).

*VC61: North Cave Wetlands 08.08.2012 E.D.Chesmore

*VC62: Tholthorpe 13.08.2017 K.Dowdall

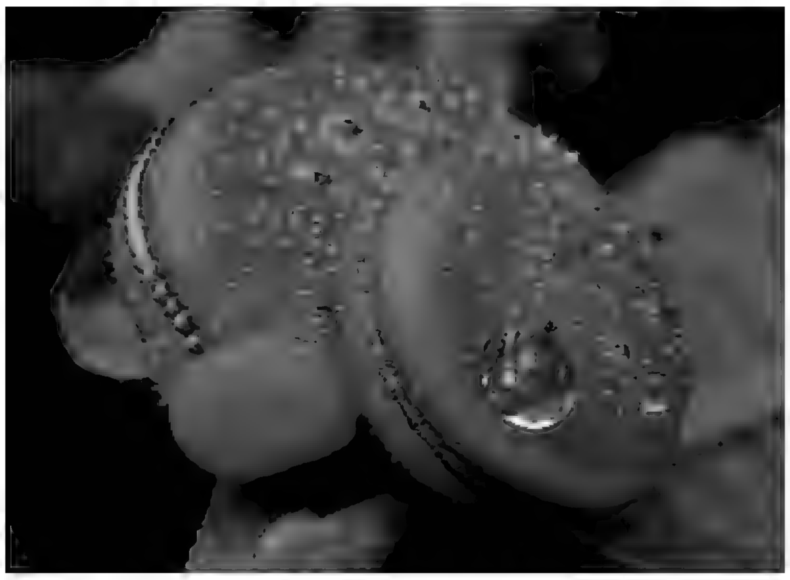

Figure. 1. *Cimbex luteus* (p64). Larva on *Salix* at Calley Heath YWT.

Figure. 2. *Monsoma pulveratum* (p65) Female on Alder at Calley Heath YWT.

TENTHREDINIDAE

Subfamily Allantinae

Ametastegia albipes Thomson, 1871

A local species with larvae perhaps associated with *Populus tremula*.

*VC61: Elvington NR 12.05.2011 R.Crossley

*VC62: Sand Dale 31.05.2009 A.J.Halstead

Ametastegia carpini Hartig, 1837

Larvae feed on *Geranium* spp.

*VC61: Holme-upon-Spalding-Moor 01.09.2013 E.D.Chesmore

Empria alector Benson, 1938

Larvae feed on *Filipendula ulmaria*.

*VC61: White Carr 09.05.2020 I.J.Andrews

Empria excisa Thomson, 1871

Larvae feed on *Rubus spp*. and *Filipendula vulgaris*.

*VC62: Fen Bog 30.05.2009 A.J.Halstead

Empria immersa Klug, 1818

Larvae feed on *Salix* spp.

*VC62: Stony Marl Moor 29.05.2009 A.J.Halstead

Empria pumila Konow, 1896

Larvae probably associated with *Filipendula ulmaria*.

*VC61: Mask Meadow SSSI 17.04.2019 R.Crossley

Monsoma pulveratum Retzius, 1783

Larvae feed on *Alnus* spp. (See Figure.2, p64)

*VC61: Calley Heath 07.05.2019 I.J.Andrews

Eriocampa ovata Linnaeus, 1760

The distinctive, white-woolly larvae feed on *Alnus* spp.

*VC65: Low Force path 14.06.2019 G.Dalley

Subfamily Athaliinae

Athalia rosae Linnaeus, 1758

Formerly very uncommon, with only two records pre 2000, but known as an occasionally irruptive species. Recent years have seen a surge in records and it is now seemingly a common resident as well across the county. (See Figure.3, p68)

*VC62: Forge Valley Wood 29.05.2009 A.J.Halstead

*VC64: Swillington Ings 05.08.2018 A. Musgrove

*VC65: High Batts NR 21.06.2019 K.Limb

Subfamily Blennocampinae

Claremontia waldheimii Gimmerthal, 1847

Larvae feed on *Geum rivale* and cultivars.

*VC62: Forge Valley Wood 29.05.2009 A.J.Halstead

Monophadnoides ruficruris Brullé, 1832 New to Yorkshire

Larvae feed on *Rubus* spp.

ɟVC61: Calley Heath 13.05.2018 I.J.Andrews

Periclista albida Klug, 1816

Larvae feed on *Quercus* spp.

*VC61: Calley Heath 25.05.2019 I.J.Andrews

*VC63: Wath Wood 26.04.2019 H.Nickels

Periclista pubescens Zaddach, 1859

Larvae feed on *Quercus* spp.

*VC61: Calley Heath 25.05.2019 I.J.Andrews

*VC63: Wadsley and Loxley Commons 31.05.2020 A.Smith

*VC64: Meanwood, Leeds 27.05.2019 P.Almond

Eutomostethus gagathinus Klug, 1816

Larvae feed on *Juncus* spp., *Carex paniculata*, and *Carex hirta*.

*VC61: North Newbald Becksies YWT 25.05.2020 I.J.Andrews

*VC62: Seivedale Fen 20.06.2020 I.J.Andrews

Eutomostethus nigrans Konow, 1887 New to Yorkshire

Larvae feed on grasses such as *Poa* spp. Previously considered a form of *E.ephippium* Panzer 1798, but recently raised to full species by Blank and Taeger 1998; told by the black rather than red thoracic dorsum. Earlier first records will likely come to light in the future.

*VC61: Allerthorpe Common 08.05.2020 I.J.Andrews

ɟVC62: Thornton Dale, Dalby Forest 09.06.2019 I.J.Andrews

Phymatocera aterrima Klug, 1816

Solomon's-seal Sawfly has been widespread in gardens for some time, though with limited records; thanks to the distinctive larvae on the foodplant, 36 new records came through via iRecord and iNaturalist in 2020 alone.

*VC65 Hutton Conyers, 30.05.2020 C.H.Fletcher

Subfamily Heterarthrinae

Caliroa annulipes Klug, 1816

The slug-like larvae feed on *Quercus spp.*, *Salix* ssp. and similar, skeletonising the underside of leaves.

*VC61: North Cliffe Woods 05.09.2020 I.J.Andrews

Fenella nigrita Westwood, 1840

Larvae mine leaves of *Potentilla* spp. and *Agrimonia eupatoria*.

*VC61: Dimlington 14.08.2013 W.A.Ely

*VC65 Brompton-on-Swale 01.07.2013 W.A.Ely

Fenusa pumila Leach, 1817

Larvae mine the leaves of *Betula* spp., especially *B. pubescens*.

*VC62: St.Nicholas Fields, York 16.09.2020 S.Buckton

*VC65: Hutton Conyers 09.10.2016 C.H.Fletcher

Fenusella nana Klug, 1816

Larvae mine the leaves of *Betula* spp., especially *B. pubescens*.

*VC65: Hutton Conyers 27.08.2016 C.H.Fletcher

Metallus albipes Cameron, 1875

Larvae mine leaves of *Rubus idaeus* and *Rubus fruticosus agg.*

*VC61: North Grimston 02.09.2013 W.A.Ely

*VC65: Brafferton 06.10.2013 W.A.Ely

Metallus lanceolatus Thomson, 1870

Larvae mine the leaves of *Geum* spp. Few Yorkshire records, but probably widespread.

*VC61: Elloughton Dale 05.09.2013 W.A.Ely

*VC62: Kirby Misperton, Flamingo Land 20.09.2013 W.A.Ely

*VC65: Hutton Conyers 31.08.2016 C.H.Fletcher

Metallus pumilus Klug, 1816

Larvae mine leaves of *Rubus idaeus* and *Rubus fruticosus agg.*

*VC62: Ingleby Arncliffe 30.09.2013 W.A.Ely

Knayton 30.09.2013 W.A.Ely

*VC65: Brafferton 06.10.2013 W.A.Ely

Profenusa pygmaea Klug, 1816

Larvae mine the leaves of *Quercus* spp.

*VC65: Manfield 03.09.2012 W.A.Ely

Profenusa thomsoni Konow, 1886 New to Yorkshire

Larvae mine the leaves of *Betula* spp. Possibly overlooked, as seemingly not uncommon at Allerthorpe Common and Calley Heath YWT in VC61.

ɟVC61: Allerthorpe Common 01.06.2019 I.J.Andrews

Heterarthrus microcephalus Klug, 1818

Larvae mine the tips of leaves of *Salix* spp.

*VC61: Skipwith Common 14.04.2018 J.Small

Heterarthrus wuestneii Konow, 1905 New to Yorkshire

Liston *et al.* 2019 separate this species from *H. fiora* Liston 2019 (previously *H. aceris* Kaltenbach, 1856) and *H. cuneifrons* Altenhofer & Zombori, 1987 by foodplant, this being the only one to use *Acer campestre*. On that basis, the species can be added to the Yorkshire list through reference to

the foodplant in old records.

*VC62: Danby Wiske 29.06.2013 W.A.Ely
*VC63: Cawthorne 02.07.1988 W.A.Ely
ɟVC64: Copmanthorpe 13.07.1983 K.P.Payne
*VC65: High Batts NR 21.07.2014 W.A.Ely

Subfamily Nematinae

Cladius rufipes Serville, 1823 New to Yorkshire
Larvae feed on *Ulmus* spp.
ɟVC61: Holme-upon-Spalding-Moor 08.06.2013 E.D.Chesmore

Hemichroa crocea Geoffroy, 1785
Larvae feed gregariously on *Alnus* spp., *Betula* spp. and *Corylus avellana*
*VC62: Westerdale, Hob Hole 03.10.2017 J.Small
*VC65: Garsdale, 17/09/2020 C.H.Fletcher

Nematinus fuscipennis Serville, 1823
Larvae feed on *Alnus* spp.
*VC64: Askham Bog 28.05.2011 R.Crossley

Nematinus luteus Panzer, 1803
Larvae feed on *Alnus* spp.
*VC61: Calley Heath 19.06.2020 I.J.Andrews
*VC62: Seivedale Fen 20.06.2020 I.J.Andrews

Hoplocampa chrysorrhoea Klug, 1816
Larvae feed on *Prunus* spp.
*VC61: East Cottingwith 18.04.2011 R.Crossley

Euura annulatus Gimmerthal, 1834
Larvae feed on *Rumex* spp.
*VC61: Allerthorpe Common 19.05.2020 I.J.Andrews

Euura bridgmanii Cameron, 1883
Larvae feed on broad-leaved *Salix* spp.
*VC65: Freeholders Wood, Aysgarth 10.06.2017 T.Higginbottom

Euura hedstroemi Malaise, 1931 New to Yorkshire
Larvae feed on *Salix aurita* and *S.atrocinerea*
ɟVC61: East Cottingwith 27.04.2019 J.Small

Euura histrio Serville, 1823
Larvae feed on *Salix*.
*VC61: Pocklington 05.04.2020 I.J.Andrews

Euura incompleta Förster, 1854
Larval food plant not known.
*VC61: White Carr 09.05.2020 I.J.Andrews

Euura leucapsis Tischbein, 1846
Larvae feed on *Salix aurita* and *S. cinerea*.
*VC61: North Cave Wetlands 17.04.2019 I.J.Andrews

Euura leucosticta Hartig, 1837
Larvae feed on *Salix cinerea*, *Salix aurita* and *Salix caprea*
*VC61: Skipwith Common 02.05.2011 R.Crossley

Euura miliaris Panzer, 1797
Larvae feed on *Salix* spp. and *Populus* spp.
*VC61: Allerthorpe Common 02.10.2020 I.J.Andrews

Euura papillosa Retzius, 1783
Larvae feed on *Populus* spp., *Salix* spp. and *Betula* spp.

*VC61 Calley Heath 15.09.2020 I.J.Andrews

Euura piliserra Thomson, 1863 New to Yorkshire

Larvae feed on *Salix viminalis* and *Salix dasyclados*

ɟVC64: East Keswick Fitts 06.07.2017 J.Small

Euura poecilonota Zaddach, 1876

Larvae feed on *Betula* spp.

*VC61: Skipwith Common 18.08.2018 J.Small

Figure. 3. *Athalia rosae* (p65) Once scarce, but now apparently a common resident as well as migrant.
Figure. 4. *Pristiphora testacea* (p69) Distinctive larvae with a row of egg-yellow spots laterally.

All photos I.J.Andrews

Euura vicina Serville, 1823

Larvae feed on *Betula* spp., *Populus* spp., *Salix* spp. and *Rumex obtusifolius*

*VC61: Allerthorpe Common 19.05.2019 I.J.Andrews

Euura viridissimus Möller, 1882

Larvae feed on *Alnus glutinosa*.

*VC61: Calley Heath 13.05.2020 I.J.Andrews

Mesoneura opaca Fabricius, 1775

Larvae feed on *Quercus* spp.

*VC61: Calley Heath 13.05.2019 I.J.Andrews

Nematus lucidus Panzer, 1801

Larvae feed on *Crataegus* spp. and *Prunus spinosa*.

*VC62: Seivedale Fen 26.05.2020 I.J.Andrews

Nematus septentrionalis Linnaeus, 1758

Larvae feed gregariously on *Alnus* spp., *Betula* spp. and other deciduous trees.

*VC65: Abbey Hill 12.08.2017 J.Clark

Pristiphora confusa Lindqvist, 1955

Larvae feed on certain *Salix* spp.

*VC61: Skipwith Common 18.08.2018 J.Small

*VC62: Stony Marl Moor 29.05.2009 A.J.Halstead

Pristiphora conjugata Dahlbom, 1835

Larvae feed gregariously on *Populus nigra*, *Populus tremula* and *Salix* spp.

*VC61: Calley Heath 09.07.2020 I.J.Andrews

Pristiphora geniculata Hartig, 1840

Larvae feed on *Sorbus aucuparia* and other *Sorbus* spp.

*VC61: Calley Heath 21.07.2020 I.J.Andrews

Pristiphora monogyniae Hartig, 1840
Larvae feed on *Prunus* spp.
*VC61: Wheldrake 05.06.2016 J.Small
Pristiphora subbifida Thomson, 1871
Larvae feed on *Acer campestre.*
*VC61: North Cave Wetlands 03.06.2020 I.J.Andrews
Pristiphora testacea Jurine, 1807
Larvae feed on *Betula* spp. (see Figure.4 p68)
*VC61: Calley Heath 15.08.2020 I.J.Andrews
Subfamily Selandriinae
Aneugmenus coronatus Klug, 1818
Larvae feed on *Athyrium filix-femina*, *Dryopteris felix-mas* and *Pteridium aquilinum*.
*VC61: Calley Heath 13.05.2020 I.J.Andrews
*VC62: Seivedale Fen 12.07.2017 I.J.Andrews
Dolerus germanicus Fabricius, 1775
Larvae on *Equisetum*.
*VC65: Romaldkirk, Hayberries NR 16.06.2019 M.C.Harvey
Dolerus gilvipes Klug, 1818 New to Yorkshire
Larvae probably feed on *Equisetum?* Formerly considered a subspecies of *D. pratorum* Fallén, 1808.
ɟVC62: Little Beck Wood 30.05.2009 A.J.Halstead
Dolerus stygius Förster, 1860
A rare *Dolerus* whose larvae feed on sedges.
*VC61: East Cottingwith 18.04.2011 R.Crossley
*VC65: Foxglove Covert 27.04.2011 R.Crossley
Dolerus varispinus Hartig, 1837
Larvae feed on grasses.
*VC61: Pocklington 08.04.2020 I.J.Andrews
Dolerus yukonensis Norton, 1887
Larvae thought to feed on *Equisetum*.
*VC61: Three Hagges Wood 09.05.2016 A.Grayson
Pseudohemitaxonus sharpi Cameron, 1879 New to Yorkshire
Larvae feed on ferns, incl. *Athyrium filix-femina* on the continent. A rare species nationally.
ɟVC62: Keldy Ponds 29.05.2019 I.J.Andrews
Stromboceros delicatulus Fallén, 1808
Larvae feed on ferns within woodland.
*VC61: Hagg Wood, Dunnington 17.05.2011 R.Crossley
Subfamily Tenthredininae
Macrophya alboannulata Costa, 1859
Larvae feed on *Sambucus nigra*.
*VC61: Calley Heath 03.05.2020 I.J.Andrews
Macrophya annulata Geoffroy, 1785
Larvae feed on *Rosa* spp.
*VC61: Fulford Ings 03.06.2011 R.Crossley
Pachyprotasis antennata Klug, 1817
Larvae feed on *Filipendula ulmaria* and *Fraxinus* spp.
*VC61: Three Hagges Wood 02.06.2017 A.Grayson
Tenthredo amoena Gravenhorst, 1807
Larvae feed on *Hypericum* spp.
*VC61: North Cave Wetlands 16.07.2019 I.J.Andrews

*VC62: Crossgates Quarry, Eastfield 10.06.2020 D.Lombard

Tenthredo omissa Förster, 1844

Larvae feed on *Plantago* spp.

*VC61: Tophill Low 22.07.2019 J.Barnard

Tenthredo scrophulariae Linnaeus, 1758

Larvae feed on *Scrophularia* spp.

*VC65: Mickleton 17.07.2016 L.Hodgson

References

Benson, R.B., (1952). *Handbooks for the Identification of British Insects. Hymenoptera, Symphyta, Vol 6, Section 2(a-c)*, Royal Entomological Society, London.

Blank, S.M. and Taeger, A., (1998). *Comments on the taxonomy of Symphyta (Hymenoptera). Pflanzenwespen Deutschlands (Hymenoptera, Symphyta)*. Krefeld, pp.141-174.

Coldwell, J.D., (2003). Entomological Report 1998-2001 Hymenoptera: Symphyta *The Naturalist* Vol.128 pp. 35-36.

Halstead, A.J., (2004). Berberis sawfly, Arge berberidis Schrank (Hymenoptera: Argidae), a pest new to Britain. *British Journal of Entomology and Natural History,* 17(3), pp.131-135.

Liston, A., Mutanen, M. and Viitasaari, M., (2019). On the taxonomy of Heterarthrus (Hymenoptera, Tenthredinidae), with a review of the West Palaearctic species. *Journal of Hymenoptera Research, 72*, p.83.

Macek, J., Roller, L., Benes, K., Holy, K., Holusa, J. (2020) *Blanokridli Ceske a Slovenske republiky II. - Symphyta. [Hymenoptera of the Czech and Slovak Republics II - Symphyta]*, Academia, Prague.

Pesarini, F., (2019). *Fauna D'Italia Vol.LII Hymenoptera Symphyta I*. Calderini.

Prous, M., Liston, A., Kramp, K., Savina, H., Vårdal, H. and Taeger, A., (2019). The West Palaearctic genera of Nematinae (Hymenoptera, Tenthredinidae). *ZooKeys, 875*, p.63-127.

Taeger, A. and Viitasaari, M., (2015). European Rhogogaster s. str., with notes on several Asian species (Hymenoptera: Tenthredinidae). *Zootaxa*, 4013(3), pp.369-398.

Bibliography

Gibbs, D.J. (1984) A review of the Symphyta fauna of the Sheffield Area. *The Sorby Record* No.22.

Liston A, Knight G, Sheppard D, Broad G, Livermore L (2014) Checklist of British and Irish Hymenoptera - Sawflies, 'Symphyta'. *Biodiversity Data Journal 2*: e1168.

A very special suburban wildlife site

Peter Middleton

Email: peter@middletonbellecology.co.uk

Introduction

Barnsley in South Yorkshire is a town with a population of 91,297 at the 2011 census. The Metropolitan area encompasses many former mining villages and the whole of the borough has a population of almost a quarter of a million, with the wider county of South Yorkshire having an estimated population of approximately 1.4 million in 2017. It is not therefore a place that many would associate with sites rich in wildlife; however, the opposite is true as

the borough comprises a wide variety of habitats, and not least an important site close to the town centre. Whilst the nature conservation interest in upland areas of the Barnsley area in the Peak District National Park and the wetlands of the Lower Dearne Valley are realised, the Upper Dearne Valley is perhaps not fully appreciated. Indeed, it is a place where industrial heritage and wildlife coexist in an extensive area of grassland and wetland habitat bordered by suburbia.

The Upper Dearne Valley is the section of the River Dearne downstream of Bretton Sculpture Park where it flows through the suburbs of the town. It is mostly surrounded by the built environment which supports a large proportion of the town's population. Nevertheless, in spite of the narrowness of the valley in places, it remains an important corridor linking the river and the lakes of Bretton Park on the border with West Yorkshire with the lower Dearne Valley sites, including the well-known Old Moor Nature Reserve to the east.

The town itself occupies a fairly steep hill to the southwest of the river valley with the town hall in the centre of Barnsley less than one kilometre from the River Dearne. This section of river valley comprises various areas or place names including The Fleets, Willowbank and Wilthorpe Marsh. This short article describes the wildlife associated with approximately 3.9km of the valley between Old Mill Lane Bridge adjacent to the Asda supermarket where the A61 crosses the river and the B2648 to the northwest at Lower Barugh (Figure 1, p72).

History

The coal mining industry has shaped and influenced the valley directly and indirectly through time and in 1850 there were six mines in the section of the valley which is the subject of this article, all of which had ceased operation by the end of the 19th century. In the beginning there were no transport links to distribute the coal produced here to the wider region, therefore, in 1793, work began near Wakefield on the construction of the Barnsley Canal. This runs through the valley from east to west, and the Barnsley section was in operation by 1799. Competition in the form of railways started to affect the canal from 1849 when a line through the valley was opened with the aim of providing access to the South Yorkshire coalfield (Marshall 1969). The decline of the waterways is well documented and following several major breaches of the canal, it was abandoned in 1953 (Hadfield, 1973). An opencast mining scheme in the valley shortly afterwards unfortunately resulted in the loss of a 500m section of the canal towards the western end.

For most of the 20th century there were three collieries in operation in and around the upper Dearne valley in Barnsley: Redbrook colliery on the south side of the valley and Darton and North Gawber collieries on the north side. The effects of these mines can still be seen today as mine flood water erupts from deep underground creating a warm water stream which eventually flows into the River Dearne (Figure 2, p72). This feature, together with other outlets nearby, are important factors that have resulted in a high water table and extensive areas of marsh. Flashes caused by mining subsidence have also been a prominent feature of this section of the valley, especially since the turn of the century.

Figure 1. Area of interest indicated by arbitrary green line boundary.

Habitats have become dynamic through continued mining subsidence, increased rainwater runoff (from development and agricultural soil deterioration), increased precipitation through global warming, plus the forces of natural succession. The last mining operation was a small opencast scheme undertaken by UK Coal at the far west end of the valley near Lower Barugh in 2005 which resulted in the delivery of some mitigation, albeit poor.

Figure 2 (left). Warm water stream with vapour visible on this 2020 frosty spring mornin**g.**
Figure 3. (right). Barnsley Canal and Tow Path.

Unfortunately, the valley is afforded little in the way of protection; the RSPB showed some interest for a short while in 2004 but this came to nothing. At the same time UK Coal were planning opencast mining in several areas of the valley on land that they owned and there may have been an opportunity for mitigation to include habitat enhancement, creation and management when they became exhausted. However, following opposition from the local community to the opencast scheme, UK Coal abandoned the idea, leading them to sell their land holding at auction. Unfortunately, the valley was sold off to various landowners, some of

which are sympathetic to nature conservation, and some who aren't. Barnsley Council still own the canal and some adjacent areas which are a Local Wildlife Site but the long-term future of this and the wider valley area is less secure.

Changing habitats

There are four main habitats in the valley with perhaps the largest component comprising various grassland types including unimproved neutral and acid grassland, semi-improved neutral grassland and marshy grassland all of which are grazed by cattle or horses. Wetland habitat includes extensive areas of marsh, open water on the former oxbows of the River Dearne where the river has been straightened, two large fishing ponds, the tree-lined Barnsley Canal (Figure 3, p72) and the River Dearne itself. Other habitats include streams, ditches, rush pasture, scrub, willow carr, arable and woodlands, the latter two occupying areas of the valley sides above the flood plain.

The habitats have seen rapid change, especially recently. For example, the canal has breached in several places resulting in lower water levels. Former meadows in the eastern section have become heavily poached and infested with species tolerant of nutrient enrichment as a result of continued overgrazing. Part of the river has been straightened and the former oxbows now comprise areas of open water and marsh (Figure 4) whilst a little arable land in the west of the site has been lost to marsh as the valley bottom appears to have become wetter. In less than 30 years this subsidence flash, which appeared on arable land in the 1990s and at the time attracted breeding and passage wading birds, was abandoned (for agriculture) and as a consequence of the absence of grazing, natural succession has transformed the area into marsh and willow *Salix* scrub. Therefore, whilst overgrazing by horses in the valley has been a problem in some areas in recent times, the lack of it in other areas of the valley is also not desirable.

Flora and Fauna

Figure 4 (left). Oxbow area of the river, the yellow flowers are buttonweed *Cotula coronopifolia.*
Figure 5 (right). Winter roosting habitat for Long-eared Owl.

More than 400 species of vascular plants, including species difficult to find elsewhere in the borough, have been recorded in the valley, making it the district's richest botanical site. Notable mammals present in this area include Otter *Lutra lutra* and Daubenton's Bat *Myotis daubentonii* on the river adjacent to the A61. The Daubentons' roost at the east end of the site was once probably of national importance with in excess of 400 bats (Bennett, pers. comm);

however, since the floods in 2007 which inundated Old Mill Lane and the roost culvert (a Local Wildlife Site), numbers are now vastly reduced, with only 67 recorded exiting in 2011 (TEP 2011). Numbers do not appear to have recovered. However, this may not necessarily be the case as there is a suspicion that there is an additional roost which has yet to be discovered, possibly downstream. Other species of bats which inhabit this part of the valley include Noctule *Nyctalus noctula* and Leisler's bat *Nyctalus leisleri.* The author has seen Otter under the Old Mill Lane bridge twice and during a survey there an abundance of Otter spraints was located (MBE 2018).

Birds

The site is perhaps better known for its birds as it is an important site for both breeding and wintering birds together with the occasional rare or scarce species. 148 species have been recorded by only a few observers. Five species of wading bird have bred in this part of the valley in the last 20 years including Lapwing *Vanellus vanellus*, Snipe *Gallinago media*, Redshank *Tringa totanus*, Little Ringed Plover *Charadrius dubius* and Oystercatcher *Haematopus ostralegus*. Unfortunately, only Lapwing and Oystercatcher (on sewage works) are currently breeding here due to habitat loss resulting from natural succession. Overall losses of breeding birds, however, have been offset by recent gains, including Buzzard *Buteo buteo*, Rose-ringed Parakeet *Psittacula krameri* and Little Egret *Egretta garzetta*. Whilst the latter is almost ever-present, it does not breed on site but does so downstream in the far Lower Dearne Valley. At the time of writing (early spring 2021) a pair of ravens *Corvus corax* are nest building and a cetti's warbler *Cettia cetti* is singing, potentially two additions to the list of breeding birds in this part of the valley.

Nationally scarce breeding birds which breed in this part of the valley include Water Rail *Rallus aquaticus*, Long-eared Owl *Asio otus*, Kingfisher *Alcedo atthis* and Willow Tit *Poecile montanus* (Pearce & Middleton 2018). Notable breeding birds which are Red Listed and Species of Conservation Concern (Eaton *et al.,* 2015) include Sedge Warbler *Acrocephalus schoenobaenus*, Grasshopper Warbler *Locustella naevia,* Cuckoo *Culculus canorus*, Grey Partridge *Perdix perdix*, Linnet *Carduelis cannabina* and Yellowhammer *Emberiza citronella*. A survey of Water Rail undertaken by the author in 2019 located 8 territories whilst a Willow Tit survey in the spring of 2020 produced only one territory. This is a species suffering a drastic decline nationally and South Yorkshire is no exception. This area of the Dearne Valley is one of only a few sites in the lowlands of Barnsley where they remain; however, how long they will continue to be present, is a concern. Habitats here also support high numbers (>20 singing males) of breeding Willow Warbler *Phylloscopus trochilus*, Chiffchaff *Phylloscopus collybita* and Blackcap *Sylvia atricapilla* with lower numbers of Reed Bunting *Emberiza scoenichus*, Reed Warbler *Acroephalus scirpaceus*, Garden Warbler *Sylvia borin*, Common Whitethroat *Sylvia communis*, Lesser Whitethroat *Sylvia curruca*, Bullfinch *Pyrrhula pyrrhula* and Green Woodpecker *Picus viridis*. Also, there is a colony of Sand Martins *Riparia riparia* on the River Dearne and breeding Mute Swan *Cygnus olor*, Tufted Duck *Aythya fulgula*, Gadwall *Anus strepera* and Little Grebe *Tachybaptus ruficollis* on the old oxbows of the river, whilst a pair of Great Crested Grebe *Podiceps cristatus* has recently nested successfully on the Fleets fishing pond.

During times of passage migration, species of waders recorded in the last 30 years have included Ringed Plover *Charidrius hiaticula*, Little Ringed Plover, Little Stint *Calidris minuta*, Dunlin *Calidris alpina*, Wood Sandpiper *Tringa glareola*, Green Sandpiper *Tringa ochropus*,

Curlew Sandpiper *Calidris ferruginea*, Greenshank *Tringa nebularia*, Spotted Redshank *Tringa erythropus*, Avocet *Recurvirostra avosetta* and Curlew *Numensis arquata*, whilst rare passerines have included Nightingale *Luscinia megarhynchos* in 1993 and two Yellow-browed Warblers *Phyloscopus inornatus* including one as recent as 2020. Both Stonechat *Saxicola torquatus* and Whinchat *Saxicola rubetra* occur annually and during much of the spring of 2020 a Great Egret *Casmerodius alba* was also recorded daily in a location less than 1.5km from the town hall.

The site is well known for its scarce annual winter visitors including Water Pipit *Anthus spinoletta,* Jack Snipe *Lymnocryptes minimus* and Long-eared Owl (Figure 5, p73). Jack Snipe numbers are typically between two and six but occasionally in excess of 10 while the highest number of Long-eared Owls roosting together numbered six in the winter of 2019-20. Cetti's Warbler is also present during winter but so far, there is no evidence of breeding. In recent years, the site has become a regular wintering site for Water Pipits which have numbered up to five between 2017-21. A study of Water Pipits at this site was the subject of a recent article in *The Naturalist* (Lunn 2020).

The Future and concluding remarks

It would appear that the railway line south of the canal is a physical barrier which will hopefully restrict development from invading or impacting the valley's better habitats. However, the Local Authority aspired to have a new road link built which would potentially impact and dissect the western section of the valley near Lower Barugh. Fortunately, however, this appears to have come to nothing. In recent years there has been both unauthorised and authorised works undertaken near the old oxbows which has resulted in changes to the habitats on the Barnsley Canal Local Wildlife Site and the flood plain. The damage includes 'filling in' a section of the canal, destabilising the canal bank plus considerable earth movements and the removal of trees on the canal and flood plain.

Given that the valley is afforded little protection, it was unfortunate that the opportunity to secure the valley's future was lost when UK Coal sold land at auction which conservation organisations would have been interested in purchasing had they known of the sale. Furthermore, habitats could have been managed sympathetically to benefit wildlife whilst allowing controlled access for the community and enhancing what is a very valuable resource for the town. I can think of no other town of this size in the UK which has such a special area, rich in diverse semi-natural habitats, on its doorstep. Indeed, it is possible to encounter Willow Tit, Water Rail, Little Egret, Green Sandpiper and a host of other birds, not to mention Otters, within 1.5 kilometres of the town hall.

Acknowledgements

Many thanks to my friends Stuart Green and Carl Dixon who regularly watch the site and helped to compile a species list for the site. Also, Eric Bennett, a pioneer bat enthusiast, for supplying historic records for the Daubenton's bat roost on the River Dearne and GIS consultant Mark Parnell for producing Figure 1.

References

Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A. and Gregory, R.D. (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds 108, 708–746*.

Hadfield, Charles (1973). *The Canals of Yorkshire and North East England (Vol 2)*. David & Charles.
Lunn, J. (2020). Feeding, roosting and habitat preferences of wintering Water Pipits in South Yorkshire, *The Naturalist*, 145, no 1104.
Marshall, John (1969). *The Lancashire & Yorkshire Railway, volume 1.* pp. 214–5, 217–8. David & Charles, Newton Abbot.
MBE (2018). *Old Mill Lane Bat & Otter Report*. Middleton Bell Ecology, Barnsley.
Pearce, D. M. & Middleton, P. (2018) *The Atlas of Breeding Birds in the Barnsley area 2006-11*, Barnsley Bird Study Group.
TEP (2011). Old Mill Lane Culvert Bat Roost, LWS Citation, Barnsley Metropolitan Borough Council.
Yorkshire 274 (included: Barnsley; Darton; Dodworth.) – Ordnance Survey Six-inch England and Wales. 1842-1952. https://maps.nls.uk/view/102345145

For town population sizes see:
http://www.citypopulation.de/php/uk-england-yorkshireandthehumber.php

YNU Excursions 2021

All excursions in 2020 were prevented from taking place due to the restrictions caused by the Covid-19 pandemic. Last year's programme is therefore being carried forward and it is intended all excursions will take place as was planned for 2020 (be aware of further changes to Covid restrictions and check on the YNU website or with the Divisional Secretary nearer the date). To save space we are printing only the basic details and we refer you to the full details given on pages 73-79 of *The Naturalist* 1103 (April 2020). The dates change slightly and these details are given below.

CIRCULAR No. 915

Divisional Secretary VC62: Africa Gomez Email: a.gomez@hull.ac.uk

The **VC61** excursion will be held at **Flamborough Head** on **Saturday 22nd May 2021**.

Meeting place (Change from Naturalist 1103): We will meet at 10:30 at the Flamborough Lightouse car park (TA253706). From the B1255 take a right turn to Lighthouse Road (B1259) at Flamborough village (brown sign). The lighthouse car park is 1.8 miles after the turning. This is a Pay & Display car park.

Tea and Reporting Meeting: Given the anticipated restrictions for indoor meetings on the date of the meeting (rule of 6 would still apply) we won't be having a reporting meeting. Instead, we will organise a Zoom meeting after the event to collate the records. There is a restaurant/cafe and toilet facilities by the Lighthouse Car Park.

The Area: Flamborough Head has many designations - a Special Area of Conservation for vegetated sea cliffs, chalk reefs and caves; a Special Protection Area for its breeding seabirds; a Site of Special Scientific Interest and a Heritage Coast among others. The flora of the headland has a maritime and a calcareous character. Common and Grey Seals, Dolphins and Porpoises can be seen from the cliffs.

CIRCULAR No. 916

Divisional Secretary VC62: Sarah White Email: white.priests@gmail.com

The **VC62** Meeting will be held on **Sunday 13 June** 2021 at **Duncombe Park National Nature Reserve**, Helmsley.

Meeting Place: We will meet at 10:30 just inside the gates of Duncombe Park at SE612835.

The Area: Duncombe Park is believed to be the richest site in Northern England for insects, notably beetles, associated with old broad-leaved woodland. The insects of ancient woodland found at Duncombe Park are thought to occur as relict isolated populations. This will be the first YNU Excursion to Duncombe Park.

CIRCULAR No. 917

Divisional Secretary VC63: Joyce Simmons Email: joyce@gentian.plus.com

The VC63 Excursion will be to the **central Dearne Valley**, Barnsley on **Saturday 3 July 2021**

Meeting Place: Meet at 10:30 in the free car park on the A633 at SE372064 to the east of Barnsley. The car park is just north of the River Dearne bridge to the east side of the road.

Reporting Meeting: At the Mill of the Black Monks on the A633 opposite the car park at 16:00.

The Area: Historical industrial abuse of the Dearne Valley led to 500ha being given a Nature Improvement Area grant of £2.5M for restoration of meadows and woodland. This is a chance for naturalists to see how the area has bounced back (see articles on p30 and p70).

CIRCULAR No. 918

Divisional Secretary VC64: Ken White Email: white.zoothera@gmail.com

The **VC64 Meeting** will be held at **YWT Askham Bog Nature Reserve**, York, on **Saturday 17 July 2021**.

Meeting Place: We will meet at 10:30 at the Askham Bog reserve car park on A1036, SE575479. Nearest postcode YO23 2UB. There are no facilities at the car park; nearest toilets are at the Askham Bar Park & Ride, YO23 2BB.

Reporting Meeting: At 16:00 at the Pike Hills Golf Club, Tadcaster Rd., YO23 3UW.

The Area: Askham Bog is now a valley mire lying between two arms of the York moraine. The YWT reserve extends for 88 hectares (110 acres). Alkaline water draining from the moraine has led to the development of a rich fen community. In the middle of the site conditions have become acidic through the leaching action of rain-water. The site supports a number of nationally and internationally significant species and plant communities.

CIRCULAR NO. 919

Divisional Secretary VC65: Terry Whitaker Email: t.whitaker1@btinternet.com

The VC65 excursion is to the Howgill Fells, Cautley Holme Beck (SD6897) on **Saturday 14 August 2021**.

Meeting place. Nr. Cross Keys Inn, Cautley, Sedbergh (SD698969).

The Lepidoptera group is invited to trap in the area on 14 August (Friday night). Meet at SD698969. No electricity supplies are available.

Reporting Meeting at 16:00, Cross Keys Inn, Cautley, Sedbergh (SD698969).

The area: Known for its variety of upland grassland habitats and its Bryophytes, the area is less known zoologically, with only 7 macro moths recorded in 2 of its 1km squares. There are several areas worthy of more study - the YNU last visited the area in 1961.

Book Review

Deep Dale: making space for nature in a North Yorkshire forest. Edited by **Brian Walker**.

ISBN 978-1-906604-73-8. Published by PLACE. pp76. Price £6.50 (incl. p&p); available from: PLACE office, York St. John University, Lord Mayor's Walk, York YO31 7EX (Email: place@ yorksj.ac.uk)

What was established in 1919 as the Forestry Commission, formed in the aftermath of the First World War as a means of increasing UK timber stocks, has undergone significant changes over the past century. Criticised for despoiling the landscape value of some of our most treasured areas with its rectangular blocks of conifers, during the second half of the 20th century the Forestry Commission has broadened its scope considerably to incorporate more sensitive design through pioneering people like Dame Sylvia Crowe and now manages its holdings to benefit biodiversity, as well as to enhance public access and recreation. Brian Walker, who joined the then Forestry Commission (now known as Forest England) in 1976 as one of its first recreation officers, has seen many of these changes first hand in Teeside and North Yorkshire and has chosen its centenary to edit this compact volume on Deep Dale, a relatively small area in the north-east corner of Dalby Forest on the North Yorkshire Moors.

Interest in the area started in the mid-1980s when some remnant flora were spotted and the potential for restoration of rich meadow and calcareous habitat recognised. The book first describes the historical and archaeological context of Deep Dale, together with details on the geology that is responsible for some interesting tufa deposits and the calcareous nature of the habitat. The book then considers the period after the incremental removal of Norway Spruce, focusing particularly on the botanical surveys to monitor the development of the meadow and adjacent marsh, starting with a baseline survey in 1993 and then subsequent ones in 1996 and 2019. Shorter sections towards the end of the book describe some faunal surveys, including bats, lepidoptera and carabid beetles, together with mammals and birds caught on camera traps.

The two botanical surveys from the 1990s are, apart from some appendices and a map, reproduced in full by scanning paper copies. This means that details of sampling techniques, determination of quadrat locations and lists of species recorded in each quadrat are given in full. Inevitably there were differences between each survey in terms of species recorded and their relative abundances. The difficulties in drawing meaningful conclusions from these changes are well considered in a section on 'Comparing the surveys'. A key concluding message of the book is to give due recognition to the late Peter Robinson who undertook the 1993 survey and 'put the science into Deep Dale', thereby providing the hard evidence so necessary when conservationists need to convince the wider community of the benefits of what they are doing.

The book is attractively presented with a good number of colour images and the sections containing scanned survey reports make for variety in fonts and layout style. There are a few very minor niggles with the presentation. I would have preferred the present-day location maps at the start of the book to help orientate the reader before going into the details of the area,

rather than at the back, and it might have helped to have a hierarchy of font sizes to distinguish more between the titles of sections and sub-sections.

Nonetheless, this is an inspiring record of how field naturalists and Forestry Commission employees have collaborated to undertake a long-term project in enhancing and monitoring habitat quality in the depths of Dalby Forest. It should appeal not only to those familiar with the area but also those interested in how the 100-year evolution of the Forestry Commission has manifested itself in a small area of North Yorkshire.

Andy Millard

Maggots go 'Gentle' into the archives …Part 1

Colin A. Howes

In April 1985 the corpse of a 17ft Minke Whale *Balaenoptera acutorostrata* which had temporarily stranded in the lower Trent at Burton on Stather (SE8618) and the lower Ouse at Goole Fields (SE7526) finally beached on a very high tide on the saltings at Broomfleet Island (SE8826) in the upper Humber estuary (Howes *et al.* (1987).

The specimen skeletonised very rapidly and on 10 March 1986 most of the post cranial skeleton and jaws were collected by CAH and Anne Naylor for Doncaster Museum. It was later discovered that the skull had been separately collected by the staff of the Town Docks Museum, Hull.

After washing and sterilising the skeletal elements, the bones were spread out to dry, prior to being packed for storage. Whilst drying a number of lively fly larvae emerged from pores along the jawbones. They were particularly fascinating in being capable of jumping when disturbed. This was achieved by attaching their mouth-parts to their terminal segments, tightening their muscles and letting go when a critical tension had been reached. This enabled them to jump many times their own body length.

The larvae were identified generically by Peter Skidmore as 'Cheese Skippers' of the dipterous family Piophilidae. I am not aware that any were collected with a view to later identification and have long assumed these were the domestic (anthropogenic) species *Piophila casei* (Linnaeus, 1758), traditionally associated with foodstuffs such as cheese and bacon. However, since larvae collected from the bones of stranded whales in Iceland were identified by Nielsen *et al.* (1954) as *Liopiophila varipes* (Meigen, 1830) it is possible the Humber specimens may have belonged to this or related taxa. Interestingly, most of the few records of *L. varipes* on the NBN database are from coastal localities.

References

Howes, C.A., Boyd, M.J. and Cutts, D.B. (1987) A review of Minke Whale (*Balaenoptera acutorostrata* Lacèpéde) in the Humber and Yorkshire waters. *The Naturalist* 122: 9-14.

Nielsen, P., Ringdahl, O. and Tuxen, S.T. (1954) Diptera, 1 (exclusive of Ceratopogonidae and Chironomidae). *Zoology of Iceland* 3 (48A): 1-189.

YNU Calendar

YNU Annual General Meeting

Saturday 9 October 2021 at **St John's Methodist Church Hall, Settle** BD24 9JH. 1.30pm to 4.30pm**.** The AGM will be hosted by Craven Conservation Group and followed by a presidential address by **Dr Judith Allinson**.

It will be preceded in the morning by a programme of workshops and displays and the opportunity for a meeting of the Natural Sciences Forum.
For more information and booking visit www.ynu.org.uk/AGM

Themed Zoom Meetings

Apr 15 Louise Hill **'Lindholme, Hatfield Moors'**. Start 7:30pm - it will then be available as a recording.

It is hoped to organise further themed Zoom sessions in the autumn, details of which will be given in the August edition of *The Naturalist* and publicised on our website. If you would like to deliver a themed Zoom session yourself please email: editor@ynu.org.uk

Zoom Chat Sessions

These more informal Zoom meetings are open to members of the YNU and of affiliated societies and provide an opportunity for you to talk about items of natural history interest. For details please email: judithallinson22@gmail.com

Entomological Section		
Oct	16	AGM at Potteric Carr NR Education Centre. 11.00am to 12.30pm; open to public exhibits 1.30pm to 4.30pm. TBC.
Botanical Section		
Jun	14	Farwath in Newtondale. VC62 Joint meeting with the North East Yorkshire BSBI Botany Group. Meet 10.30. For further details contact Wendy English (wendy.english@btopenworld.com).
Jun	20	Fishlake Green Lanes and Washlands. VC63 Meet 10.00, Blackshaw Lane, SE666157 just north of Fishlake Village. Contact Louise Hill (louise.a.hill@googlemail.com).
Jun	23	Eskeleth Beck and Fotheringholme SSSI. VC65. Arkengarthdale. NY999037. Contact Linda Robinson (lindarobinson157@ btinternet.com).
Bryological Section		
May	8	Scoska Wood and Brown Scar, Littondale. VC 64 Meet at 10:00 in Arncliffe, near the Falcon Inn SD931718. Contact: Tom Blockeel (Tblockeel@aol.com).
Oct	2	Jugger Howe. VC 62. Meet at 10:00 am at Helwath Bridge SE954995. Contact: Tom Blockeel.
Executive		
Sept	11	Meet in the Lounge at St Chad's Parish Centre, Leeds, 10.30am to 12.30pm. TBC.

Yorkshire Naturalists' Union

c/o NEYEDC, 10a Minster Gates, York YO1 7HL
Tel: 01904 641631   Email: membership@ynu.org.uk
Website: www.ynu.org.uk
Registered Charity No. 224018

The Naturalist

This publication is issued free to individual members of the Yorkshire Naturalists' Union and to Affiliated Societies. The Editorial Board of *The Naturalist* is currently:

Notice to contributors

Contributors should indicate whether they wish their manuscripts to be subjected to anonymous peer review. All other manuscripts will be reviewed by the Editorial Board who at their discretion may send them to third parties for comment and advice.

Original articles should be submitted electronically as an MS Word document to Dr A. Millard at:
editor@ynu.org.uk

Please look at a recent issue of the journal for a general idea of how to present your article. Also see *The Naturalist - Guidance for authors* at www.ynu.org.uk/naturalist and please **avoid** the following:

- using any paragraph formatting and line spacings other than single.
- using tabs to tabulate information (please use MS Word table format).
- inserting any figures, graphs or plates into the text; indicate their proposed locations in the text and send them as separate files.

Good quality, high resolution images are very welcome and should be sent as .jpg files, with a separate MS Word file containing the caption and name of the person to whom the image should be attributed.

If electronic submission is not possible, contributions should be sent to Dr. A. Millard, Woodland Villas, 86 Bachelor Lane, Horsforth, Leeds LS18 5NF (Tel. 0113 258 2482).

Contributors should ensure the accuracy of reference citations. The Editorial Board and Council accept no responsibility for opinions expressed by contributors.

Copy Dates:
April issue - 14 February; August issue - 14 June; December issue - 14 October

***The Naturalist* is printed by Swallowtail Print, Norwich**

ISSN 0028-0771

Yorkshire Naturalists' Union